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PALEONTOLOGY.—*Annotated list of Pleistocene Mammalia from American Falls, Idaho.*[1] C. LEWIS GAZIN, U. S. National Museum. (Communicated by J. B. REESIDE, JR.)

Pleistocene vertebrate remains have been encountered at several localities along the course of the Snake River in southern Idaho. In the eastern part of the basin the fossils occur in loose sand and gravel and have been uncovered as a result of placer mining or quarrying for road material. At American Falls the fossils were discovered in a gravel quarry a short distance from the eastern end of the American Falls dam. The deposits in the pit consist of alternate layers or lenses of gravel and sand capped by an argillaceous mud, the bones occurring principally in the gravel and coarser sand.

While in Idaho during the summer seasons of 1929 and 1930, Dr. J. W. Gidley, accompanied by C. P. Singleton, visited American Falls and obtained for the National Museum a collection of vertebrate fossils. In 1934 the locality was investigated by the writer's party and additional material uncovered. The greater part of the collection consists of the remains of relatively large animals; apparently, small, fragile specimens were not readily preserved, hence the list is very incomplete.

The assemblage recognized is clearly Pleistocene and may represent a glacial stage as suggested by the presence of musk-ox remains. As to the portion of the Pleistocene represented no certain evidence is apparent in the known fauna. Dr. O. P. Hay[2] cited forms occurring in these gravels at various localities together with the fauna then recognized as from the Idaho formation in the western part of the basin and the whole was allocated to the Nebraskan stage. This procedure was unwarranted as the faunas may be quite distinct, certainly when comparisons are made with the Hagerman assemblage.

[1] Published by permission of the Secretary, Smithsonian Institution. Received February 12, 1935.

[2] HAY, O. P. Carnegie Inst. Wash. Pub. 322B: 268–269. 1927.

EDENTATA

Megalonyx cf. jeffersonii (Desmarest)

Megalonychid remains from American Falls consist essentially of two jaw portions and miscellaneous foot bones. Description of this and the mylodont material has been presented in an earlier paper.[3] No new information is furnished by the additional material obtained in 1934.

Paramylodon harlani? (Owen)

Remains of mylodont sloth are scarcer in the gravel pit than those of *Megalonyx* and, since the sloth material collected by Gidley was described, a fourth metacarpal and an ungual claw have been added to the collection.

CARNIVORA

Cf. **Aenocyon dirus** (Leidy)

The distal portions of two humeri and an abraded phalange cannot be distinguished from the corresponding parts of the large dog *Aenocyon dirus* as represented at Rancho La Brea.

Canis sp.

An incomplete humerus, a tibia and a third metatarsal are recognized as belonging to a dog somewhat smaller than *Canis occidentalis* but larger than a coyote.

Urocyon? sp.

A small fox is indicated in the fauna by a fragmentary mandible portion. The specimen is without teeth but exhibits the alveoli for the posterior root of the carnassial, M_2 and the single rooted M_3.

Ursid sp.

The proximal end of a large femur and a fragmentary distal end of a humerus included in the collection are recognized as bear. The specimens suggest an individual about the size of the Alaskan brown bear, *Ursus gyas*, although the form represented may well be one of the large arctotheres. The fragment of a humerus is not sufficiently complete to show the presence or absence of an entepicondylar foramen.

Felis near **F. atrox** Leidy

Representing the cat is a fourth metacarpal, no. 13723 U. S. N. M., and a radius, no. 13747 U. S. N. M. The total length of the fourth metacarpal is 114 mm., this being smaller than the average in *Felis atrox* of Rancho La Brea but somewhat greater than the minimum figure given by Merriam and Stock.[4] However, the fourth metacarpal appears relatively slenderer than

[3] GAZIN, C. L. Jour. Mammalogy, 16: 52–60. 1935.
[4] MERRIAM, J. C., and STOCK, CHESTER. Carnegie Inst. Wash. Pub. 422: 131–133, table 60, fig. 96. 1932.

the Rancho La Brea specimen figured. The radius is 312 mm. long, which is 5 mm. under the least figure given by Merriam and Stock for this element. The radius is comparable in size to radii in large individuals of *Felis leo*. It is possible that an unusually large individual of *Felis daggetti* is represented.

RODENTIA

Citellus sp.

In the scant collection of rodents from American Falls are five fragmentary mandibles of ground squirrel. In only one of the jaws are any teeth preserved and these are so badly worn that the cusp pattern is entirely obliterated. The specimens represent a small species apparently close in size to *Citellus richardsonii*. A resemblance is also seen to *Citellus elegans*, although the fossil jaws differ somewhat from both modern forms in having a relatively longer cheek tooth row, as indicated by the alveoli.

Thomomys cf. townsendii (Bachman)

Pocket gophers are represented by eight mandible portions and a number of limb elements. Four of the jaws retain P_4 and in one the second molar is preserved. The species is distinctly large and compares favorably with *Thomomys townsendii*, now living in the vicinity of American Falls. Comparison, however, with several specimens of *T. townsendii* show the teeth in the fossil jaws to be somewhat wider than the average in living specimens.

Castor sp.

The beaver material includes the greater part of a tibia, the distal end of a femur and two metapodial fragments. These indicate a beaver somewhat larger than *Castor canadensis*, approaching in size the later Pliocene beaver found at Hagerman. Possibly the species *Castor accessor* Hay is represented although no teeth were found on which to make a comparison.

Erethizon sp.

A single left ramus of a mandible without cheek teeth and retaining only the base of an incisor is recognized as porcupine.

LAGOMORPHA

Lepus sp.

A relatively large hare is indicated by several fragments of tibiae and femora, the distal end of a humerus, two calcanea, two metapodials and phalanges. The form represented may be *Lepus townsendii* or *Lepus californicus*. From the age of the deposits it is unlikely that *Hypolagus* is included.

Sylvilagus? sp.

A fragment of a lower jaw without teeth, and a few fragments of limb bones show the presence of a second and distinctly smaller leporid. The jaw

is about the size of that in the brush rabbit, *Sylvilagus bachmani*. Although the form represented may be a species of *Brachylagus*, the living *Brachylagus idahoensis* possesses a somewhat smaller jaw.

PROBOSCIDEA

Mammut americanum (Kerr)

Included in the mastodon material is a right mandibular ramus, No. 13701 U. S. N. M., in which is preserved a moderately worn last molar. The specimen corresponds closely to other specimens in the National Museum identified as this species.

Elephas columbi? Falconer

Two maxillary portions in the collection, one of which No. 13703 U. S. N. M., retains a partially worn last molar and the other, No. 13702 U. S. N. M., a badly worn second molar in addition to the third, are apparently to be referred to the columbian mammoth.

PERISSODACTYLA

Equus cf. occidentalis Leidy

Horse remains consist of an assortment of teeth and foot bones. The teeth are appreciably smaller than in *Equus pacificus* as represented at Christmas and Fossil Lakes in Oregon, and somewhat smaller than the type of *Equus idahoensis*. The specimens do not differ greatly in size from *Equus occidentalis* material from Rancho La Brea but the enamel pattern is slightly more complicated, comparable in this respect to the type of *E. occidentalis* as illustrated by Leidy.[5] The pattern on the teeth varies considerably between specimens but is distinctly simpler than in most teeth described as *Equus complicatus*.

ARTIODACTYLA

Camelops cf. hesternus (Leidy)

Perhaps the most abundant material obtained from the gravel deposit is that of camel. This includes considerable limb and foot material and an assortment of upper and lower teeth. There are also a maxillary portion of the skull with three molars, No. 13718 U. S. N. M., a premaxillary-maxillary fragment, No. 13719 U. S. N. M., with the third incisor and alveolus for the canine, and three incomplete mandibles. One of the lower jaws, No. 13720 U. S. N. M., possesses a complete, though well worn, cheek dentition. The form is apparently close to *Camelops hesternus* as identified at Rancho La Brea, and probably identical to *Camelops minidokae* Hay[6] from a gravel bed

[5] LEIDY, JOSEPH. U. S. Geol. Surv. Terr. Rept., 1: pl. 33, figs. 1–2. 1873.
[6] HAY, O. P. Op. cit., 90–93, pl. 8, figs. 2–3. 1927.

near Minidoka, Idaho. The American Falls jaws do not show evidence of a vestigal P_3 seen in the type of *C. minidokae* but this character may not have been persistent in the Minidoka camel as the teeth are otherwise similar to those in the American Falls form. Comparisons between the premaxillary-maxillary portion and the type of *Camelops kansanus* as illustrated by Merriam[7] show the alveoli for I^3 and C to be somewhat larger but less widely separated in the American Falls specimen. However, no important differences in teeth and foot material were observed when comparisons were made with *Camelops kansanus* from Hay Springs, Nebraska.

Cf. **Antilocapra americana** (Ord)

Two humeri, a tibia, calcaneum and an incomplete anterior cannon bone in the collection are nearly identical with those in the living prong-horn antelope. It is interesting to note that these elements with the possible exception of the cannon bone can be closely approximated in the mule deer, *Odocoileus hemionus* and in the columbian black-tailed deer, *Odocoileus columbianus*.

Bison alleni Marsh

Nearly all of the bison material in the collection, which is almost as abundant as camel, is referred to *Bison alleni*. A cranial portion, No. 13692 U. S. N. M., including the right horn-core and a somewhat larger isolated horn-core, No. 13693 U. S. N. M., are so close to the type of *B. alleni* that the identity is not questioned. In addition to the horn material are portions of seven jaws, a number of loose teeth and a variety of limb and foot bones. The size of the limb and foot bones in addition to the heaviness of the horns indicate an animal of considerable robustness.

Bison sp.

An isolated bovid cannon bone, No. 13713 U. S. N. M., in the collection is considerably smaller than those referred to *Bison alleni* and compares favorably with the corresponding element in a small individual of *Bison occidentalis* as recognized in a Pleistocene collection from Riverton, Minnesota.[8]

Symbos cavifrons (Leidy)

The collection includes two incomplete musk-ox skulls, a portion of a palate with two molars on each side, a fragment of a lower jaw and a few isolated teeth. The two skulls exhibit both horn-cores and the occipital region, but the rostral portion is missing in one and only partially preserved in the other. The skulls are characterized by unusually robust horns, the extremities of which extend well out from the skull. It may be noted that in much of the described skull material referred to *Symbos cavifrons* the horns are less robust and more rapidly tapering than in the type as illustrated by

[7] MERRIAM, J. C. Univ. Calif. Pub. Bull. Dept. Geol. 7: 305–323, figs. 10a–10b. 1913.
[8] HAY, O. P. Proc. U. S. Nat. Mus. 63: art. 5: 1–8, pls. 1–2. 1923.

Osgood,[9] whereas the American Falls specimens have even heavier and longer horns which stand out from the side of the skull somewhat more than in the type. It is estimated that the distance between the extremities of the horn-cores on one of the specimens, though the tips are not complete, would be about 680 mm. The anteroposterior diameter at the base of the horn is about 115 mm. and the vertical diameter about 102 mm.

[9] OSGOOD, W. H., Smithsonian Misc. Coll., Quart. Issue, 3: pt. 2, 173–185, pl. 40, fig. 1, pl. 41, fig. 1. 1905.

BIOLOGY.—*Longevity and fertility in the pond snail,* Lymnaea columella.[1] CHARLES P. WINSOR AND AGNES A. WINSOR. (Communicated by RAYMOND PEARL.)

The essential preliminary to any reasoned, quantitative discussion of population problems is accurate knowledge of birth and death rates. Unfortunately, such knowledge is almost completely non-existent. Aside from our knowledge about man, virtually everything that we know of birth and death rates in other forms is due, directly or indirectly, to Pearl. Under these circumstances it seems legitimate to add a certain amount of data, even though it fails to conform in all respects to the standards set by Pearl on *Drosophila.*

The data here presented deal with duration of life and fertility in the pulmonate gastropod *Lymnaea columella.* Some account of the biology and laboratory husbandry of this animal has already been given by Baily (1) and by ourselves (7).

The conditions under which the observations were made may be stated briefly. Eggs from wild snails isolated in the laboratory were collected and separated before hatching; from each egg mass 10 eggs were placed in one finger bowl and 2 eggs in each of five others. A total of 180 snails was used in each series. Leaf lettuce was used as food, except for a period of about four weeks during which iceberg lettuce was used. The substitution was unavoidable, and unfortunate. Lettuce and water were changed three times a week; the conditions were arranged so that light and temperature were reasonably uniform for all animals.

The wild parents of the snails were collected in two ponds in the vicinity of Baltimore, designated here as the Falls Road pond and the Boyce Avenue pond. In addition to these wild ancestors of known origin, two snails isolated from laboratory aquaria furnished eggs for

[1] From The Department of Biology of The School of Hygiene and Public Health, The Johns Hopkins University, and The Biological Laboratories, Harvard University. Received March 14, 1935.

this experiment; nothing is known concerning their origin. These animals were isolated in the laboratory in finger bowls with about 150 ml. of spring water, fed with leaf lettuce, and their eggs collected

TABLE 1.—PERCENT SNAILS SURVIVING AT GIVEN AGES (RECKONED FROM OVIPOSITION)

Age in Days	Percent Surviving Initial Density 2	Percent Surviving Initial Density 10
15	100.0	100.0
25	91.6	76.4
35	79.9	62.4
45	77.1	47.9
55	76.0	47.3
65	74.9	45.5
75	74.3	45.5
85	74.3	45.5
95	70.4	43.7
105	70.4	42.5
115	68.2	38.8
125	67.0	37.6
135	64.3	34.6
145	60.9	34.0
155	50.3	31.0
165	41.9	25.5
175	30.7	22.5
185	18.4	10.9
195	4.5	4.8
205	2.2	0.6
215	1.1	0.0
225	0.0	

daily. The eggs so obtained were allowed to develop for about a week, at which time healthy-appearing clutches were selected for the experimental population. These eggs were removed from the capsule and placed in finger bowls with spring water.

TABLE 2.—BIOMETRIC CONSTANTS OF DURATION OF LIFE

	Initial Density 2	Initial Density 10
Mean	128.8 ± 3.2 days	88.7 ± 3.6 days
Standard Deviation	63.4 ± 2.3 days	70.2 ± 2.5 days
Coefficient of Variation	49.2 ± 2.1%	79.1 ± 5.3%

Table 1 and Figure 1 show the survivors at given ages out of 100 snails hatching. Table 2 gives the mean, standard deviation, and coefficient of variation of duration of life for each series.

It will be observed that these life tables differ from those hitherto published for *Drosophila* and other forms, in that there is present a

high infant mortality. We do not feel entirely certain, however, that this mortality is not at least partially attributable to experimental technique. Of the total deaths under forty days, just over half, in each series, were due to snails crawling out of water and drying on the dish (45

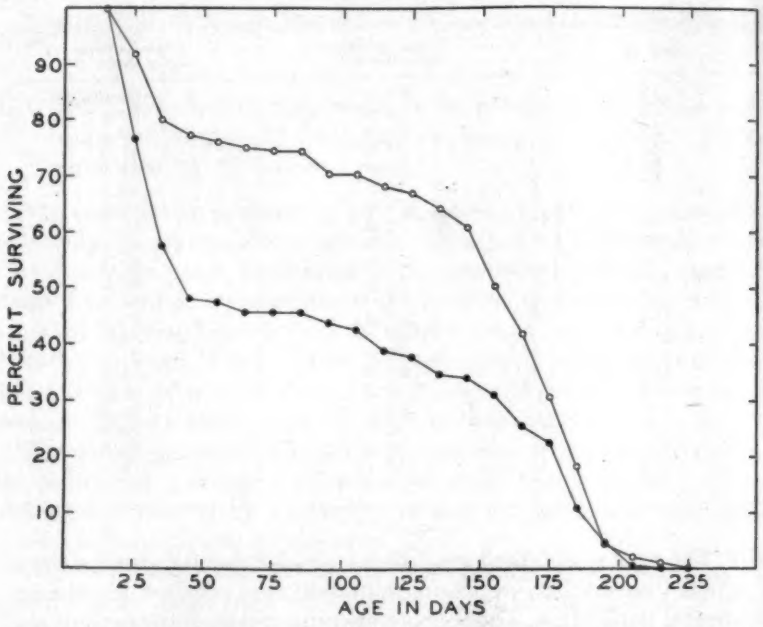

Fig. 1.—Percent snails surviving to given ages. Open circles density 2; solid circles density 10.

out of 85 deaths in the 10 snail series, 22 out of 40 in the 2 snail series). But we may observe that (a) this mortality is markedly higher in the high density series, and (b) there remains a high infant mortality even after deaths from desiccation have been excluded. Whether improved technique would eliminate infant mortality is not certain, though we are disposed to believe that it would.

We may further note that except for infant mortality there are no significant differences in the life tables at the two densities.

In Table 3 are presented data relative to egg production. In this table we have indicated the parentage of the snails considered, and for each parent we have grouped the data according to the density at the date of deposition of the first eggs. We have calculated in each case

the egg production per snail at each density, and also the egg production per snail-day in excess of 70 days. (The figure of 70 days corresponds approximately to the date of earliest egg production; no es-

TABLE 3.—EGG PRODUCTION

Parent	Density	Number of Cases	Total Eggs	Eggs per Snail	Total Snail-days over 70	Eggs per Snail-day
1	3	1	658	219	260	2.53
	2	2	1,298	325	276	4.70
	1	2	1,604	802	189	8.48
2	7	1	1,283	183	664	1.94
	6	1	1,116	186	577	1.94
	5	1	1,729	346	422	4.09
	2	10	18,542	927	1,573	11.15
	1	4	3,907	977	308	12.66
4	5	2	7,316	732	813	9.00
	3	1	594	198	147	4.04
	2	9	22,489	1,249	1,748	12.86
	1	4	7,360	1,840	430	17.12
8	4	1	1,404	351	326	4.31
	2	7	4,941	353	1,076	4.59
	1	4	3,512	878	408	8.61
12	4	1	1,731	433	405	4.27
	2	8	9,729	608	1,571	6.19
	1	3	3,048	1,016	346	8.81
15	5	1	3,404	681	530	6.42
	2	4	6,192	774	856	7.23
	1	1	51	51	57	.90
16	8	1	2,427	303	588	4.13
	4	1	2,724	681	481	5.66
	2	8	11,090	693	1,737	6.38
	1	2	1,431	715	188	7.61
17	3	1	1,972	657	339	5.82
	2	3	4,609	768	660	6.98
	1	1	778	778	123	6.33
A-2	3	1	2,367	789	241	9.82
	2	1	2,640	1,320	222	11.89
	1	5	8,404	1,681	541	15.53
A-3	3	1	4,398	1,466	358	12.28
	2	3	5,948	991	530	11.22
	1	2	3,023	1,511	206	14.67

sential change is introduced if we use some other figure, as 60 days, or even if we use total snail days.)

There are two features of this table which deserve comment. First, considerable differences in fertility exist from one strain to another, which suggest genetic differences. Second, and more important, there

is a clearly marked effect of density of population on fertility. With very few exceptions, there is a regular increase in fertility per head, however measured, as density decreases. (The exceptions may reasonably be attributed to sampling fluctuations.) We thus see that in these animals the same effect of density on fertility exists which Pearl (5) has found in *Drosophila*. Whether the mechanism of the effect is similar cannot at present be stated.

A third point which seems to us of some interest relates to the reproductive physiology of these animals. As we have already shown, isolated animals lay more eggs than pairs. Further, observation indicates that the proportion of viable eggs is as high in the eggs laid by singles as in those laid by paired animals. On the other hand, Boycott and Diver (2), who, in the course of their genetic work have raised enormous numbers of *Lymnaea*, state that cross-fertilization is apparently the rule; and that isolated animals will reproduce, but apparently only as a last resort, their egg production beginning markedly later than that of pairs.

TABLE 4.—AGE IN DAYS AT FIRST OVIPOSITION, PAIRS AND SINGLES

Pairs			Singles	
Wild Parent	Number of Dishes	Mean Age at First Oviposition	Number of Dishes	Mean Age at First Oviposition
1	2	91.0	2	122.0
2	10	77.7	4	75.0
4	9	78.4	4	77.0
8	6	95.3	4	87.3
12	7	82.9	3	78.7
15	4	85.7	1	94.0
16	7	93.1	2	82.5
17	3	91.3	1	92.0
A-2	1	81.0	5	72.8
A-3	3	76.3	2	76.5
General Mean		86.2		82.3

We have examined our records and present in Table 4 data showing the mean age at first oviposition of singles and pairs. We have grouped the animals by parentage, because there seem to be considerable differences among strains as to age of reaching maturity. The numbers are not large, and the results not too consistent; but we think it is clear that singles lay at least as early as pairs. Whether this difference between our results and those of Boycott represents a difference in the physiology of the species, or a difference in experimental conditions, we cannot say.

The interest of the observation, we may remark, lies in the problem

it suggests. We know that the animals are hermaphroditic and capable of self fertilization; but we also know, from Boycott's work and from that of Piaget (6), that cross-fertilization takes place if opportunity is offered. The anatomy of the animals, as Crabb (3, 4) has shown, would appear to make cross-fertilization extremely improbable, unless some physiological mechanism not apparent anatomically actively favors foreign sperm. What the nature of this mechanism may be seems a problem worth the attention of some qualified worker.

SUMMARY

(1) Life tables for *Lymnaea columella* are presented for two different initial densities, 2 and 10 snails per dish.

(2) Data on egg production show differences in fertility between strains, and show marked reduction in fertility with increasing density of population.

(3) No significant differences exist in the date of first oviposition as between isolated and paired animals.

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BOTANY.—*Three new plants from Death Valley, California.*[1] C. V. MORTON, National Museum. (Communicated by FREDERICK V. COVILLE.)

The following three new species are from the collections made in Death Valley in 1931 and 1932 by Dr. Frederick V. Coville and associates, under the sponsorship of the National Geographic Society.

Ephedra funerea Coville & Morton, sp. nov.

Frutex pallidus, dioicus, erectus, usque ad 1.3 m. altus, ramosissimus; ramuli teretes, ca. 3 mm. crassi, striati, asperi, glandulosi, apice pungentes;

[1] Published by permission of the Secretary of the Smithsonian Institution. Received March 25, 1935.

folia terna, ad vaginas reducta, ca. 5 mm. longa; spiculae ♀ uniflorae vel interdum biflorae, sessiles, solitariae vel geminae, ambitu ellipticae, ca. 10 mm. longae; bracteae unguiculatae, margine leviter crenulatae, maturae plus minus erectae, dorso vix incrassatae, pallido-virides, alis scariosis, lutescentibus, basi cuneatis; fructus viridis, vix exsertus, elongato-pyramidatus, apice acuminatus, laevis, nec scaber nec papillosus; tubillus rectus exsertus; semina matura desunt.

Type in the U. S. National Herbarium, no. 1,565,472, collected at Furnace Creek Canyon, on the Ryan-Shoshone road, Death Valley, Inyo County, California, altitude about 1,000 meters, April 26, 1932, by Frederick V. Coville and M. French Gilman (no. 447).

Additional specimens examined, all from Death Valley are as follows:

CALIFORNIA: Furnace Creek Canyon, near the old town of Ryan, April 25, 1932 (*Coville & Gilman* 444, 445, 446); Furnace Creek Canyon, Junction of the Dantes View road with the Ryan-Shoshone road, April 26, 1932 (*Coville & Gilman* 448); Warm Springs Canyon, Panamint Mountains, about a mile above Warm Springs, April 30, 1932 (*Coville & Gilman* 502, 502a); Boundary Canyon, alt. about 1,050 meters, April 24, 1932 (*Coville & Gilman* 407, 408, 409, 410); Furnace Creek Canyon, alt. about 770 meters, April 16, 1931 (*Coville & Gilman* 19); Furnace Creek Canyon, alt. about 950 meters, April 18, 1931 (*Coville & Gilman* 108, six specimens, all from different plants); Dantes View, alt. about 1,800 meters, April 18, 1931 (*Coville & Gilman* 95); pass above Ryan, on road between Furnace Creek Ranch and Shoshone, June 11, 1930 (*Thackery, Gilman, & Peebles* 284c); slope of Salsberry Pass, Funeral Mountains (*Charles Brown*); one mile south of Ryan, *C. L. Hitchcock* 12329 (Herbarium University of California); two miles east of Bradbury Well, *J. T. Howell* 3643 (Herbarium California Academy of Sciences).

The present species is most nearly related to *Ephedra californica* S. Wats., which has not been found in the Death Valley region. In *E. californica* the fruits are broadly elliptical with rounded apices, in contrast to the elongate, acuminate fruits of *E. funerea*. The fruiting scales of *E. californica* are fleshier, more closely appressed, shorter-clawed, and usually borne in more numerous series. *Ephedra funerea* differs somewhat in habit also, being very spinose, intricately branched, and very pale green.

Ephedra torreyana S. Wats., not as yet found in California, may be easily distinguished by its more spreading, scarious bracts and its minutely scabrous fruits.

Eriogonum panamintense Morton, sp. nov.

Subg. *Oregonium*, Sect. *Racemosa;* herba perennis, 20–30 cm. alta, erecta, stricta; rami e basi numerosi, dichotome vel trichotome ramosi, ramulis paucis, rigidis, ca. 1.5 mm. crassis, floccoso-tomentosis; folia radicalia longe petiolata, petiolis usque ad 2 cm. longis, supra paullulum canaliculatis, dense albido-tomentosis, laminis ellipticis, ovatis vel obovatis, 16–25 mm. longis, 10–16 mm. latis, apice rotundatis vel subacutis, basi cuneatis, utrinque dense floccoso-tomentosis; folia caulina orbicularia, ad nodos verticillata,

petiolis brevibus; involucra solitaria, sessilia, pauca, 3–5 mm. longa, extus albido-tomentosa, intus glabra, obtuse angulata, apice 5-dentata, dentibus ca. 1 mm. longis, acutis, margine incurvis; pedicelli numerosi, ca. 7 mm. longi, glabri, basi bracteati, bracteis setaceis, ca. 4 mm. longis, barbulatis, ex involucro haud exsertis; perianthium campanulatum, ca. 5 mm. longum, segmentis omnibus oblanceolatis, usque ad 1.5 mm. latis, albis (nervo medio purpureo excepto), glabris, integris, apice rotundatis, basi cuneatis; stamina 9, filamentis basi barbatis, sursum scabridulis, haud exsertis, antheris purpureis; ovarium scabridulum, album, trigonum; fructus deest.

Type in the U. S. National Herbarium, nos. 1,565,892–4, collected at Wild Rose Summit in the watershed of Hanaupah Canyon, Panamint Mountains, Inyo County, California, altitude about 2,600 meters, September 15, 1931, by Frederick V. Coville and Arthur F. Gilman (no. 6).

The present species is most closely related to *Eriogonum wrightii* Torr., but differs from all forms of that species (some of them probably deserving of subspecific rank at least) in numerous characters, as summarized in the following key:

Plants not suffrutescent at base or densely caespitose; basal leaves few, comparatively large and long-petiolate, mostly rounded at apex, not at all revolute, without fascicles of small leaves in the axils; stem leaves restricted to nodes of the inflorescence, verticillate, rotund and short-petiolate, obtuse; involucre 3–5 mm. long; perianth 5 mm. long, the segments oblanceolate..... **E. panamintense.**

Plants suffrutescent and much branched at base or densely caespitose; leaves many, distributed along the stem, smaller and shorter-petiolate, usually somewhat revolute, all acute, with numerous fascicles of small leaves in the axils; involucre up to 3 mm. long, usually less; perianth usually 3 mm. long or less, rarely up to 4 mm. long, the segments obovate..... **E. wrightii.**

Cymopterus (Aulospermum) **gilmani** Morton, sp. nov.

Herba 12–23 cm. alta, basi fibrosa; caulis foliosus brevis, 3–7 cm. longus, glaber, internodiis brevibus; lamina foliorum pinnata vel subdigitata, trifoliolata, ambitu orbicularis vel late elliptica, ca. 5 cm. longa et lata, pallida et glaucescens, glabra, nervis prominentibus, petiolis elongatis quam foliis duplo vel triplo longioribus, glabris, perspicue striatis, basi dilatatis, purpurascentibus, marginibus scariosis caules amplectentibus; foliolae laterales sessiles, ad medium vel fere ad basin bipartitae, ambitu late flabellatae, maximae 4 cm. longae et 5 cm. latae, segmentis secundariis bipartitis, segmentis tertiariis inaequaliter 2- vel 3-dentatis, segmentis ultimis deltoideis vel triangularibus, acuminatis, integris, maxime 10 mm. longis et basi 7 mm. latis; foliola terminalis similis sed saepe petiolulata et basi decurrens; folia caulina similia sed minora; pedunculus elongatus, fructu 8–18 cm. longus, folia superans, glaber, sulcatus; umbellae compositae; involucri bracteae nullae; radii ca. 8, floriferi usque ad 1 cm. longi, valde inaequales, fructu 1–1.5 cm. longi; involucellorum bracteae ca. 8, lineari-subulatae, ca. 3.5 mm. longae, basi ca. 0.8 mm. latae, apice incurvae, virides, haud scariosae, haud connatae, fructu ampliatae, ca. 5 mm. longae et basi 1 mm.

latae, nervis medialibus prominentibus; umbellulae ca. 15-florae, floribus centralibus 4 vel 5, valde immaturis, fere sessilibus (sterilibus?); pedicelli 1.5–2 mm. longi, ca. 0.5 mm. lati, glabri, striati, erecti, fructu non elongati; sepala conspicua, deltoidea, acuta, viridia vel purpurascentia, ca. 0.3 mm. longa; petala alba vel alabastro purpurascentia, oblanceolata, apice valde et longe acuminata, incurva, ca. 2.3 mm. longa (apice ca. 0.8 mm. longo), ca. 0.8 mm. lata, nervis medialibus prominentibus; filamenta longa, alba, incurva, antheris purpureis; ovarium glabrum, ca. 1 mm. longum, disco prominente, undulato; stylopodium nullum; fructus late ellipticus, ca. 7 mm. latus et 8 mm. longus, dorso valde compressus, apice emarginatus, albus, glaber, alis lateralibus perspicuis, magnis, linearibus, basi leviter angustatis vel dilatatis, ca. 2.5 mm. longis, 0.6 mm. latis, textura spongiosissimis, alis dorsalibus 1 vel 2, similibus, plus minusve reductis, alis vel jugis intermediis nullis; vittae valleculares ca. 7 (in fructu 3-alato) vel 4 (in fructu 4-alato), commissurales ca. 10, conspicuae, lineares, vittis basi alarum nullis; semen facie planum, dorso leviter carinatum.

Type in the U. S. National Herbarium, no. 1,565,689, collected on cliffs along a north fork of Echo Canyon, Funeral Mountains, California, altitude about 1,200 meters, April 19, 1931, by Frederick V. Coville and M. French Gilman (no. 116).

A flowering specimen also has been collected, viz: Slope of Grapevine Mountains, north of Leadfield, Titus Canyon, Death Valley, California, altitude about 1,500 meters, April 25, 1932, by Coville and Gilman (no. 433). An additional fruiting specimen was collected in Titus Canyon, Death Valley, May 8, 1934, by M. French Gilman (no. 1197).

Miss Mildred Mathias on a visit to Washington some time ago kindly looked at the present plant (already determined as an undescribed species but of doubtful affinity), and suggested a relationship with *Aulospermum basalticum* (Jones) Tidestrom (*Cymopterus basalticus* Jones). That species is known only from the type collection, which has been made available for study through the courtesy of Prof. P. A. Munz, of Pomona College. A careful comparison of the two indicates that they are somewhat closely related, at least superficially. The tabulation which follows gives some of the more important distinguishing characters.

In Miss Mathias' recent monograph of the genus *Cymopterus*,[2] *Aulospermum* and numerous other segregate genera are retained, following Coulter and Rose's "Monograph of North American Umbelliferae." The genus *Aulospermum*, in habit quite similar to *Cymopterus*, is distinguished technically by having the seed face concave and the wing bases broadened at the base. In the present species the seed face is plane and the wing bases are either narrowed or broadened at the base, characters which approach closely to *Cymopterus*, although the more obvious relationship of the plant is with *Aulospermum basalticum* and its relatives. It seems necessary, therefore, to unite *Aulospermum* with *Cymopterus*, a conclusion with which Miss Mathias, after having studied the specimens of *C. gilmani*, is now in agreement.

[2] *A monograph of* Cymopterus, *including a critical study of related genera.* Ann. Mo. Bot. Gard. 17: 213–476. 1930.

Terminal leaflet usually narrowed to a petiolule, the leaves therefore pinnate, with the leaflets deeply divided; ultimate segments few, large, up to 10 mm. long and 7 mm. wide at base; bractlets of the involucel linear-subulate, at flowering time about 3.5 mm. long and 0.8 mm. wide at base, acuminate, distinct at base, not scarious-margined; fertile flowers all pedicellate; anthers purple; fruit about 7 mm. wide, 8 mm. long, the carpels 1- or 2-winged dorsally, the wings broad, white, very spongy (cellular structure similar to that of elder pith), either narrowed or broadened at base in cross section; oil tubes (in the 3-winged carpels) about 7 in the intervals, or (in the 4-winged carpels) 4, none in wing base, about 10 on the commissure. (Funeral Mountains, California)..... **C. gilmani.**

Terminal leaflet scarcely if at all petiolulate, the leaves therefore more nearly digitate than pinnate, with the leaflets less deeply divided; ultimate segments more numerous, very much smaller, the largest about 3 mm. long and 3 mm. wide at base; bractlets of the involucel ovate, acute, about 3 mm. long, 1.5 wide, connate at base, scarious-margined, or sometimes subrectangular, irregularly connate, truncate, erose and mucronate at summit; fertile flowers sessile; anthers yellow; fruit (not quite mature) 5 mm. wide and long, the lateral wings relatively narrow, obviously broadened at base, purplish, the dorsal wing solitary, somewhat reduced; oil tubes 5 or 6 in the intervals, 1 in the wing base, and about 8 on the commissure (Wa-Wa, Utah). **C. basalticus.**

BOTANY.—*New Asteraceae from the United States, Mexico, and South America.*[1] S. F. BLAKE, Bureau of Plant Industry.

The new Asteraceae described in this paper have been found in the course of work on material in the United States National Herbarium and on collections sent to that herbarium for identification.

Chaetospira Blake, nom. nov.

Spirochaeta Turcz. Bull. Soc. Nat. Mosc. **24** (1). 166. 1851. Not *Spirochaeta* Ehrenb. Abh. Akad. Wiss. Berlin **1833**: 313. 1834.[2]

Chaetospira funckii (Turcz.) Blake.

Spirochaeta funckii Turcz. Bull. Soc. Nat. Mosc. **24** (1). 166. 1851.

The monotypic genus *Spirochaeta* Turcz., united with *Elephantopus* by

[1] Received May 29, 1935.

[2] The volume of the Abhandlungen for 1833 in which Ehrenberg's article appears (there entitled *Dritter Beitrag zur Erkenntniss grosser Organisation in der Richtung des kleinsten Raumes*) is dated 1835 on the title page, but the article itself bears the prefatory note: "Gelesen in der Akademie der Wissenschaften am 2. Juli 1832, revidirt und mit einigen Zusätzen gedruckt im Mai 1834."

most authors but again separated by C. F. Baker[3] in his revision of the group in 1902, seems sufficiently distinct in pappus character to merit recognition. The existence of the same name of an earlier date, in current use for an important genus of Bacteria, makes it necessary to rename Turczaninow's genus. In Bentham & Hooker's Genera Plantarum it was wrongly considered specifically identical with *Pseudelephantopus spicatus* (Juss.) Rohr (*Elephantopus spicatus* Juss., *Distreptus spicatus* Cass.).

Chionolaena columbiana Blake, sp. nov.

Fruticulus paucicaulis ca. 22 cm. altus dense foliosus undique compacte et canescenter subsericeo-tomentosus aetate fuscescens, bracteis glomerulam involucrantibus flavescenti-tomentosis; folia uniformia linearia acutiuscula, lamina patente vel demum reflexa ca. 12 mm. longa 2 mm. lata, petiolo cauli arcte appresso scarioso intus glabro laminam aequante; capitula parva ca. 26-flora apice caulis dense glomerata, glomerulam ca. 12 mm. crassam effingentia; fl. fem. ca. 12, hermaph. ca. 14; achenia glabra.

Stems about 3, ascending or erectish, simple or with a single branch above, about 3 mm. thick below; internodes about 1–3 mm. long, the leaves alternate, multifariously crowded; petioles entirely concealed beneath the wool of the stem, linear-oblong, slightly widened above, 1–1.2 cm. long, 2 mm. wide, 3–4-nerved inside, densely tomentose outside; blades linear or slightly linear-spatulate, 1–1.2 cm. long, 1.5–2.5 mm. wide, bluntly callous-pointed, flattish, closely subsericeous-tomentose on both sides especially beneath, 1-nerved, the nerve somewhat impressed above, concealed by the wool beneath; leaves involucrating the glomerule yellowish-tomentose, about equaling the glomerule, of the same shape as the stem leaves; heads campanulate, 4.5 mm. high, 3 mm. thick (when moistened), densely whitish-lanate at extreme base; involucre 4–4.5 mm. high, about 4-seriate, slightly graduate, the phyllaries erect, linear or lance-linear, 0.5–1 mm. wide, obtuse or acutish, entire or slightly erose at apex, pale straw-yellowish, hyaline throughout, the outermost thinly pilose on back and with dull greenish costa extending about half their length, the others glabrous and veinless; pistillate corollas filiform, whitish, 2.5–2.8 mm. long, unequally 3–4-denticulate, ciliolate around apex; achenes (pistillate flowers) linear-oblong, 0.8 mm. long, glabrous, the pappus bristles 18–19, 2.8 mm. long, slender, minutely serrulate, united at extreme base, falling off in groups; hermaphrodite flowers fertile? (the embryo apparently normally developed), their corollas subcylindric, contracted toward middle, 3 mm. long, whitish, brownish on teeth (tube 0.7 mm., throat 1.7 mm., teeth narrow-triangular, 0.6–0.7 mm. long); achenes linear-oblong, 0.5–0.7 mm. long, glabrous, the pappus bristles 22–26, 2.8–3 mm. long, slender, slightly broadened and bluntly serrulate toward apex, united at base and often irregularly united in groups of 2 or 3 for half or nearly their full length, falling off in groups; style branches very short (0.3–0.4 mm. long), oblong, erect, rounded, papillose on back and margin, without obvious stigmatic lines.

COLOMBIA: Páramos of the Sierra Nevada de Santa Marta, about 30 miles inland from Dibulla, Dept. Magdalena, alt. about 4390 m., July 1932, *William Seifriz* 494 (type no. 1,572,394, U. S. Nat. Herb.).

I have described this species under *Chionolaena* with some hesitation. All

[3] Trans. Acad. St. Louis 12: 53. 1902.

true members of the genus hitherto known are Brazilian; the two Mexican and Central American species referred to it by Hemsley, following Bentham and Hooker, are now by general agreement placed in *Gnaphalium*. The characters and relationships of several of the smaller genera of this alliance require fresh investigation based on a full representation of the described species.

Ichthyothere grandifolia Blake, sp. nov.

Herba elata; caulis dense patenterque pilosus pilis brunneis; folia magna ovata v. ovali-ovata petiolata penninervia acuminata base longe cuneata membranacea minute calloso-denticulata utrinque pilosa; capitula numerosa apice caulis cymoso-paniculata pedicellata; phyllaria exteriora minuta dense ciliata, interiora glabra.

"Coarse herb," 2 m. high; stem stout, 6 mm. thick and more, multistriatulate, its hairs many-celled, 2 mm. long; leaves opposite; naked portion of petiole pubescent like the stem, 1.5–2 cm. long; blades of larger leaves ovate or oval-ovate, 22–28 cm. long, 9–12 cm. wide, rather shortly acuminate and somewhat falcate, minutely callous-denticulate (teeth about 0.5 mm. high, 5–15 mm. apart), featherveined (larger veins 3–4-pairs, below middle of leaf), above deep green, on surface evenly and rather densely pilose with many-celled hairs (slightly thickened at base), more densely so on costa, beneath not paler (when young very densely brown-pilose), similarly pilose (the hairs not thickened at base); upper leaves smaller, ovate or lance-ovate, 10–17 cm. long, 4–6 cm. wide; panicles terminal and from the uppermost axils, on densely brown-pilose peduncles 4 cm. long or less, together forming a flattish or convex crowded compound panicle 4–7 cm. wide, the pedicels 7 mm. long or less; heads (as pressed) 4–5 mm. high, 6–8 mm. thick; outer involucre of 5 triangular-ovate acute long-ciliate subherbaceous phyllaries 2 mm. long or less, with very short, more definitely herbaceous, glabrous, rather loose tips, the inner phyllaries (subtending the pistillate flowers) about 3, broadly ovate, boat-shaped, obtuse, thin-margined, multivittate, minutely ciliolate, glabrous dorsally or with one or two short bristles above, 5.5 mm. long; pales similar but thinner and flatter; pistillate flowers about 3, their corollas white, tubular, clavate, truncate, 1.5–1.8 mm. long, densely long-pilose except at base; disk flowers numerous, their corollas white, sparsely stipitate-glandular especially at base of tube and on teeth, 4.8 mm. long (tube 1.8 mm., throat thick-cylindric, 2.5 mm., teeth ovate, 0.5 mm. long); achenes (scarcely mature) obovoid, compressed, glabrous, epappose, 3 mm. long.

COLOMBIA: In woods, vicinity of Las Vegas, Dept. Santander, alt. 2600–3000 m., 21–23 Dec. 1926, *E. P. Killip & A. C. Smith* 16124 (type no. 1,351,893, U. S. Nat. Herb.).

Distinguished, among the species with pilose or villous stem, by its very large leaves with long-tapering base.

Polymnia maculata var. **glabricaulis** Blake, var. nov.

Caulis et pedunculi glaberrimi; folia (magna, sub-5-lobata) supra sparse tuberculato-hispidula subtus sparse hispidula et secus venas primarias hirsuta, pilis ad basin paullum incrassatis.

MEXICO: Cerro Carrizo, near San José, alt. 1465 m., Tamaulipas, 19 July 1930, *H. H. Bartlett* 10508 (type no. 1,491,521, U. S. Nat. Herb.).

From the three varieties into which I divided[4] this species some years ago, distinguished by the character of their pubescence, the present form is at once separated by its perfectly glabrous stem and peduncles. The plant is also of interest as representing the northeasternmost extension of the range of any form of the species, which has hitherto been known from Zacatecas, San Luis Potosi, and Veracruz south to Costa Rica.

Steiractinia penninervis Blake, sp. nov.

Frutex ramis tuberculato-strigosis et -strigillosis; folia mediocria lanceolato-ovata v. oblongo-ovata acuminata basi lata rotundata v. subtruncata supra scabra subtus minute et dense hispidula ad venas strigosa penninervia venis et venulis subtus prominulo-reticulatis; capitula majuscula subsolitaria breviuscule pedunculata; involucri 1.3–1.5 cm. alti phyllaria extima ovali-ovata v. oblongo-ovata 7–10 mm. longa 3–6 mm. lata basi vix contracta.

Evidently shrubby, alternately branched above; branches rather densely strigose and strigillose, in age glabrate, the hairs with small not conspicuous tuberculate bases; leaves opposite; internodes 1.5–3 cm. long; petioles strigose and strigillose, hirsute-ciliate, channeled above, naked, 1–1.5 cm. long; blades (upper leaves) 6.5–8.5 cm. long, 2.5–3.3 cm. wide, inconspicuously serrulate (teeth about 2–3 mm. apart), above rather harshly strigose and strigillose with slightly tuberculate-based hairs, impressed-veined, beneath strigose or antrorse-hispid on the principal veins, and rather densely hispidulous with antrorse or spreading, very acute, conical, tuberculate-based hairs, featherveined, the principal lateral veins about 12–15 pairs, strongly prominulous-reticulate; heads 1–4 at apex of branches, terminal and solitary in the upper axils, 5–6 cm. wide; peduncles strigose, strigillose, and laxly hirsute, 2–4 cm. long; disk in flower about 1.7 cm. high, 2 cm. thick, in fruit (as pressed) about 1.3 cm. high, 2 cm. thick; involucre about 4-seriate, graduate, the outermost phyllaries 4–5, oval-ovate or oblong-ovate, strigose, hirsute-ciliate, and very minutely strigillose, subherbaceous with short, indurated, 5–8-impressed-nerved base, the next series obovate-oblong or obovate-oval, about 10–12 mm. long, 5–7 mm. wide, obtuse, thinly subscarious-herbaceous, pilose-ciliate, on back sparsely strigose and hirsute or subglabrous, the next series oblong, subscarious, 12–15 mm. long, 3–5 mm. wide, ciliate above, glabrous on back, the inmost series similar but much shorter and narrower, minutely erose-ciliolate, glabrous dorsally; pales scarious, 8–10 mm. long, acutish, narrowed below the apex, minutely ciliolate above on margin and on the thin keel; rays probably about 12–15, neutral, golden-yellow, essentially glabrous, the tube 2.5 mm. long, the lamina elliptic-oblong, 2–3-dentate or-denticulate, about 12–14-nerved (2 of the nerves much stronger), 2.5–2.8 cm. long, 4–7 mm. wide; disk flowers very numerous, their corollas yellow, glabrous, 7.5–8 mm. long (tube 3 mm., throat slender-funnelform, 4 mm., teeth ovate, 1 mm. long); achenes obovate-oblong, 3–3.8 mm. long, compressed, blackish or olivaceous, glabrous on the sides, above narrowly marginate or winged on one or both edges and there ciliolate, the wings or margins adnate to the saucer-shaped pappus-bearing apex of achene; pappus awns about 25, caducous, slender, hispidulous, mostly subequal and about 2.2–3.3 mm. long, a few shorter and only about 0.8 mm. long.

COLOMBIA: Above San Miguel, at edge of páramo, Dept. Magdalena, alt.

[4] Contr. Gray Herb. 52: 33–34. 1917.

about 3000 m., July 1932, *William Seifriz* 398 (type no. 1,572,392, U. S. Nat. Herb.)

Distinguished from all the species of *Steiractinia* previously known, except *S. ocanensis* Blake, by its penninerved leaves. In *S. ocanensis*, of which I have for comparison only a small photograph of a specimen of the type collection (*Linden* (*Schlim*) 183) in the Kew Herbarium, the branches are conspicuously tuberculate by the persistent bases of the hairs, the leaves larger, cuneate at base, apparently much more pubescent on both sides and much less venose, and the outermost phyllaries considerably larger (12–21 mm. long).

Flourensia dentata Blake, sp. nov.

Frutex resinosus glaber valde ramosus; folia lanceolata v. rhombico-lanceolata utrinque acuta penninervia, majora 3.5 cm. lata 1.3 cm. longa utroque latere 1–4-dentata, minora saepe integra; capitula mediocria discoidea apice ramorum et ramulorum solitaria basi 1–3-foliaceo-bracteata; involucri ca. 3-seriati paullum gradati 6–9 mm. alti phyllaria extima linearioblonga v. -lanceolata, cetera obovata margine saepius laciniata; achenia sericeo-pilosa.

Much branched probably erect or erectish shrub 28 cm. high and more, the branches mostly erectish, reddish-brown, the old bark gray; leaves alternate, the internodes mostly 5–20 mm. long; petioles about 1–4 mm. long, margined above; blades of the principal leaves 1.7–3.7 cm. long, 5–15 mm. wide, widest below the middle, cuneately narrowed into the petiole, light or yellowish green, coriaceous, featherveined with about 3–5 pairs of usually obscure veins, dentate or dentate-serrate above the cuneate entire base with triangular, acute or obtuse, sometimes apiculate but not mucronate, irregular teeth 1–2 mm. high; branch leaves mostly entire, smaller, lanceolate or elliptic; heads 9–11 mm. high, 4–8 mm. thick, turbinate-campanulate, 20–26-flowered, erect, solitary at tips of usually few-bracted peduncles or branchlets mostly 1–3 cm. long, subtended at base by 1–3 spatulate or oblanceolate entire or toothed leaves 6–13 mm. long; involucre about 3-seriate, slightly graduate, appressed, 6–9 mm. high, the phyllaries rather few, thick-chartaceous, brownish, the outermost linear-oblong or linear-lanceolate, obtuse, the others obovate or oblong-obovate, somewhat ciliolate at apex, with thinner, narrow or broad, toothed to irregularly laciniate margin; corollas yellow, glabrous, 4.4–4.8 mm. long (tube 0.8–1 mm., throat cylindric to slender-campanulate, 3 mm., teeth ovate, 0.6–0.8 mm. long); pales about 8.5 mm. long, with broad scarious margin and rather abruptly set off, semi-orbicular, erose and lacerate tip; achenes (not mature) cuneate, somewhat thickened, densely silky-pilose, about 6 mm. long, 1.5 mm. wide; pappus of 2 unequal slender linear-lanceolate hispidulous awns 3–4.2 mm. long, readily deciduous, or sometimes wanting; style branches with deltoid, acute, dorsally finely hispidulous appendages.

MEXICO: Sombreretillo, Durango, 9 Nov. 1925, *S. Juzepczuk* 550 (U. S. Nat. Herb, Herb. Leningrad); "campos guayuleros, ad viam," Terreros near Pedriceño, Durango, 11 Nov. 1925, *Juzepczuk* 609 (type no. 1,492,915, U. S. Nat. Herb.; dupl. Herb. Leningrad).

The only species of *Flourensia* with discoid heads and toothed leaves previously known is *F. ilicifolia* Brandeg., of Coahuila. In that species the

leaves are rhombic-ovate, relatively broader (the blades 1.6–2.4 cm. long, 1–1.7 cm. wide), and repand-dentate with 3–6 pairs of stiffly mucronate teeth.

Verbesina lundellii Blake, sp. nov.

Perennis paucicaulis; caules glandulari-hispiduli et hispidi subsimplices paucifolii; folia majora opposita ovata acuta sessilia basi rotundato-cordatula firma triplinervia reticulata sinuato-denata utrinque viridia scabro-pubescentia; capitula 3 majuscula; involucri 2-seriati 7–8 mm. alti appressi phyllaria lineari-lanceolata acuta hispida; radii ca. 11; achenia anguste alata, pappo bidentato.

Few-stemmed herbaceous perennial, 50 cm. high, simple or with a few short branches above; stems erect, subterete, wingless, 2.5 mm. thick, striatulate, greenish, densely spreading-hispidulous with mostly conical gland-tipped hairs of varying lengths and more sparsely spreading-hispid; principal internodes 3–5 cm. long, the upper up to 10 cm.; leaves mostly opposite (4–5 pairs), with about 4 alternate ones above, sessile, not decurrent; blades of the lower leaves oval or rhombic-ovate, 1.5–3.8 cm. long, 8–23 mm. wide, acute, at base rounded to broadly cuneate, subtruncate at extreme base; blades of the middle leaves ovate, 6–7.5 cm. long, 3.5–4.2 cm. wide, acute or acuminate, at base broadly rounded and minutely cordate, stiff-chartaceous, rather yellowish green especially beneath, triplinerved a little above the base and prominulous-reticulate especially beneath, sinuate-dentate above the entire lower third or quarter with 10–12 pairs of unequal acutish callous-tipped triangular teeth 0.5–1.5 mm. high, above evenly but not densely hispid with antrorse-spreading tuberculate-based white hairs and glandular-tuberculate between them, beneath spreading-hispid on the veins and veinlets and also on them hispidulous with much shorter gland-tipped hairs; upper leaves narrower, lance-ovate, 4.5 cm. long, 1.7 cm. wide; heads 3, about 3 cm. wide, the peduncles aggregated, 3.7–4 cm. long, densely glandular-hispidulous and sparsely spreading-hispid, naked, subtended by linear to subulate bracts 1.2–2 cm. long, 1–2.5 mm. wide; disk (as pressed) hemispheric, 1–1.2 cm. high, 1.3–1.5 cm. thick; involucre about 2-seriate, subequal or slightly graduate, 7–8 mm. high, the phyllaries linear-lanceolate (1.3–1.6 mm. wide), acute, callous-tipped, appressed, subherbaceous essentially throughout, few-ribbed toward base, not densely hispid and ciliate with tuberculate-based hairs and also tuberculate; rays about 11, golden-yellow, pistillate, the tube hirsute, 2 mm. long, the lamina oval, 2-dentate, about 10-nerved, 11–15 mm. long, 5–7 mm. wide; disk flowers numerous, their corollas golden-yellow, 7 mm. long (tube pilose, 1.4 mm., throat subcylindric, 4.8 mm., teeth ovate, 0.8 mm. long); pales yellow above, with blackish keel and erect yellow tips, acute, stipitate-glandular on keel and toward apex, about 8.5 mm. long; disk achenes (immature) obovate-cuneate, glabrous, 4.8 mm. long, narrowly winged above, the wings continuous with the 2 short teeth (0.2–0.5 mm. long) of the pappus.

MEXICO: Among low scrubby oaks in the "encinal" association, on Aguila Mountain, in Salteador range, about 10 km. from Charcas, San Luis Potosi, July-Aug. 1934, *C. L. Lundell* 5392 (type no. 1,589,219, U. S. Nat. Herb.).

A member of the section *Pterophyton*, nearest *V. rothrockii* Robins. & Greenm., in which the pubescence is different, the phyllaries oblong or

elliptic and obtuse, and the principal leaves rather abruptly contracted into a strongly auriculate-clasping base.

Thelesperma scabridulum Blake, sp. nov.

Perenne (?) humile ramosum ubique scabridulum pilis brevibus incrassatis; folia lineari-filiformia apice subulato-acuta integra v. tripartita; capitula parva discoidea apice ramorum solitaria v. terna, pedunculis mediocribus; corollae lobi faucibus breviores; pappi aristae lineari-lanceolatae longe hispido-ciliatae.

Root slender, vertical, apparently perennial; stems several, 5–10 cm. high, erect or ascending, oppositely branched even from the base, densely scabridulous with short, dull white, mostly conical hairs of unequal length, leafy, the leaves mostly equaling or overtopping the heads; internodes mostly 5–10 mm. long; leaves opposite, linear-filiform, 1–3 cm. long, 0.4–1 mm. wide, thick, subulate-pointed, entire or above the middle bearing a pair of similar lobes 3–10 mm. long, sparsely pubescent like the stem, especially toward base, or nearly glabrous; peduncles solitary at apex of stem and branches and in the uppermost axils, densely pubescent like the stem, erect, slender, 0.5–2.7 cm. long; disk hemispheric, 5–8 mm. high (young fruit), 4–7 mm. thick (as pressed); involucre double, pubescent like the stem except on the scarious margins of the inner phyllaries, 4–5 mm. high, the outer phyllaries 3–4, lance-subulate, acuminate, 2–3 mm. long, 0.5–0.7 mm. wide, herbaceous, erect, very narrowly scarious-margined, the inner 7–8, ovate, acutish, 1.5–1.8 mm. wide, with herbaceous center and rather broad yellowish-white scarious margin (0.3–0.8 mm. wide), ciliolate toward apex, connate for 1–1.5 mm. at base; flowers 19–23, all hermaphrodite, their corollas golden-yellow, brown-striped, glabrous except for a few short blunt hairs on the back of the teeth, about 5 mm. long (tube 2 mm., throat cylindric-campanulate, 2 mm., teeth oblong-ovate, unequal, 4 of them 0.8–1.2 mm. long, 1 (the outermost) 1–1.4 mm. long); pales oblong, obtuse, about 4 mm. long, scarious throughout, with the midrib marked by 2 orange vittae, irregularly erose-dentate, ciliolate at apex, sometimes somewhat pubescent along midline; achenes narrowly oblong or obovate-oblong, about 3 mm. long, 1 mm. wide, somewhat thickened, straight or incurved, blackish, thickly and sometimes completely covered with irregular blunt yellowish tubercles, falling united with the pales; pappus awns 2, when well developed lance-linear, 1–1.2 mm. long, long-hispid-ciliate throughout or only above, sometimes reduced or obsolete; style branches with deltoid merely acute not cuspidate tips.

MEXICO: Open alkaline plain near railroad, between La Ventura and Ranchito de San Antonio, south of Gomez Farias, Coahuila, July-August 1934, *C. L. Lundell* 5728 (type no. 1, 589, 220, U. S. Nat. Herb.).

Distinct from any previously known species in its pubescence and dwarf habit.

Calea acoma Blake, sp. nov.

Annua, caule tenui lignescente ramoso glandulari-piloso; folia lanceolata v. lineari-lanceolata acuminata sessilia minute denticulata 3-nervia glandulari-pilosa; capitula solitaria v. terna longe pedunculata radiata mediocria; radii albi; achenia calva glabra.

Slender annual, about 40 cm. high, with few opposite branches, the stem terete, multistriate, up to 2 mm. thick, rather sparsely pilose with many-

celled spreading gland-tipped hairs, glabrate below, the branches much surpassing the main stem; internodes of main stem mostly 2–10 mm. long, of branches 0.8–4 cm.; leaves opposite, 3–6 cm. long, 2–7 mm. wide, slightly narrowed at base, remotely callous-denticulate above middle (teeth 4–5 pairs, 0.5 mm. high or less), slightly revolute-margined, herbaceous, sparsely glandular-pilose on both sides, 3-nerved, the lateral pair of nerves weaker than the costa; heads solitary or ternate at apex of stem and branches, about 1.5–2 cm. wide, the peduncles slender, 2.8–15 cm. long, erectish-pilose especially just below the head and sparsely or densely spreading-pilose with gland-tipped hairs; disk (as pressed) 6–9 mm. high, 7–12 mm. thick; involucre 3-seriate, subequal or slightly graduate, 5–6 mm. high, hemispheric, appressed, the outermost phyllaries lanceolate, acutish, about 1 mm. wide, pale and subindurate below, subherbaceous in terminal half, sparsely ciliate with partly gland-tipped hairs, otherwise essentially glabrous, the others oblong or ovate-oblong, about 2 mm. wide, obtuse or subtruncate, often somewhat erose at apex, with pale base and mostly shorter greenish submembranous venose tip, similarly ciliate; rays about 8, white, the tube spreading-pilose, 2–2.8 mm. long, the lamina cuneate, 7–8 mm. long, 3.5–4.5 mm. wide, unequally 3-toothed (teeth blunt, 1–2 mm. long), 6–8-nerved; disk flowers numerous, their corollas yellow, 3–4 mm. long (tube spreading-pilose with several-celled hairs, 1.5–2 mm. long, throat campanulate, spreading-pilose at base, 1–1.5 mm. long, teeth ovate, 0.5 mm. long); pales acute, lacerate-ciliate, otherwise glabrous, several-vittate, about 4.5 mm. long; achenes of disk narrowly obovoid-oblong, several-striate, black, glabrous, 2 mm. long, bearing at apex a minute whitish annulus (apparently left by the base of the corolla); those of ray similar; style branches finely hispidulous, with acuminate triangular appendages.

COLOMBIA: In open place, western slope of Páramo de Hatico, en route from Toledo to Pamplona, Dept. Norte de Santander, alt. 2800–2900 m., 13 March 1927, *E. P. Killip & A. C. Smith* 20721 (type no. 1,355,717, U. S. Nat. Herb.); open hillside, vicinity of Mutiscua, Dept. Norte de Santander, alt. 3300 m., 20–22 Feb. 1927, *Killip & Smith* 19637; Páramo de las Puentes, above La Baja, Dept. Santander, alt. 3500–3700 m., 25 Jan. 1927, *Killip & Smith* 18230.

Closely allied to *Calea longipes* Blake, also a Colombian plant, of which it might almost be regarded as an epappose form. In that species, however, the leaves are shorter and relatively broader, and the gland-tipped hairs of stem and leaves of the new species are normally lacking; a few are present on the peduncles, however, in one specimen (*Niemeyer* 137).

Calea subcordata Blake, sp. nov.

Frutex, caule dense hirsuto-piloso; folia late ovata obtusa basi leviter cordata brevipetiolata chartacea crenata supra scabra subtus griseo-pilosula 3–5-plinervia subtus lacunoso-reticulata; capitula solitaria majuscula radiata aurea; involucri phyllaria extima ovata herbacea interiora subaequantia vel duplo breviora; pappi paleae 20 lineari-lanceolata achenio minute hispidulo duplo longiora.

Shrub 2.5 m. high or less, with opposite branches; stem stoutish, subterete, striatulate, 2–3 mm. thick, brownish, densely spreading-hirsute-pilose, in age glabrate and gray-barked; internodes 1–6 cm. long; leaves opposite; petioles stout, naked, pubescent like the stem, 3–8 mm. long; blades 2.5–6

cm. long, 2–4 cm. wide, obtuse, bluntly callous-apiculate, at base shallowly cordate or sometimes subtruncate-rounded, above light green, densely tuberculate-hispidulous with antrorse-curved hairs, when young gland-dotted, in age subbullate, beneath densely griseous-pilosulous with spreading hairs and dotted with sessile brown glands; heads solitary at apex of stem and branches, 2.5–3.5 cm. wide, the peduncle stoutish, pubescent like the stem, 0.8–2.8 cm. long; disk (as pressed) 8–12 mm. high, 1–1.7 cm. thick; involucre hemispheric, about 4-seriate, 10 mm. high, the outermost phyllaries about 4, ovate, usually abruptly contracted above the base, obtuse, herbaceous, veiny, densely hirsutulous, appressed, the others slightly graduate, oval-oblong or oblong-obovate, broadly rounded, ciliolate at apex or glabrous, with pale indurate body and shorter, brown, paler-margined, usually ampliate, subscarious tip; rays about 18, yellow, the tube glabrous, 5 mm. long, the lamina oblong, 4-denticulate, 5-nerved, gland-dotted on back, 9.5–11 mm. long; disk flowers numerous, their corollas yellow, glabrous, 6.4–7.3 mm. long (tube 2–2.3 mm., throat funnelform, 3.4–3.8 mm., teeth triangular, with a subapical thickening on back, 1–1.2 mm. long); pales narrow, glabrous, serrulate above or with a lateral tooth on each side, 5–7 mm. long; disk achenes sparsely hispidulous or in age glabrate, 2.8 mm. long; pappus of 20 long-acuminate persistent somewhat unequal awns, the longest 5–7 mm. long.

COLOMBIA: Open hillside, La Isla, Dept. Norte de Santander, alt. 2000-2500 m., 27 Feb. 1927, *E. P. Killip & A. C. Smith* 19808 (type no. 1,354,988, U. S. Nat. Herb.); open hillside, vicinity of Charta, Dept. Santander, alt. 2000–2600 m., 1–11 Feb. 1927, *Killip & Smith* 18898; in thicket, same locality, alt. 2000 m., 1–11 Feb. 1927, *Killip & Smith* 18866.

Related to *Calea trianae* Hieron., in which the relatively narrower leaves are elliptic-ovate to lance-oblong, cuneate or sometimes rounded but not cordate at base, and not closely lacunose-reticulate beneath in the manner of *C. subcordata*.

Calea subcordata var. **hirtella** Blake, var. nov.

Rami dense hirtelli; pedunculi dense hirtelli sparsissime et breviter hispidique.

COLOMBIA: In grassland, Mesa de los Santos, Dept. Santander, alt. 1500 m., 11–15 Dec. 1926, *E. P. Killip & A. C. Smith* 15097 (type no. 1,351,036, U. S. Nat. Herb.).

This plant, described as a semiprostrate to suberect shrub up to 0.75 m. high, agrees with the typical form in all essential characters. The difference in pubescence, which is not due to weathering since it is shown by the young branches and peduncles, is sufficient to separate the plant varietally.

Bahia dissecta var. **anisopappa** Blake, var. nov.

Achenia sparse hispidula pappo irregulari 1–8-squamellato 0.4–2.8 mm. longo praedita, squamellis linearibus vel lanceolatis saepius breviter aristatis; capitula (an semper ?) subdisciformia, corollis marginalibus discum non superantibus inaequaliter 4–5-dentatis vel subbilabiatis (3+1) erectis, staminibus abortivis.

LOWER CALIFORNIA: Sandy soil along La Sanca Creek, below La Grulla,

Sierra San Pedro Martir, alt. 2040 m., 17 Sept. 1930, *I. L. Wiggins & D. Demaree* 4870 (type no. 1, 588, 187, U. S. Nat. Herb.).

Bahia dissecta was described by Gray[5] as having the lobes of the disk corollas "almost equalling the tube and throat together." Rydberg[6] describes the lobes as "much longer than the short funnelform throat," and uses this character, together with the absence of pappus, to distinguish the species generically as his new genus *Amauriopsis*. In specimens dissected I find the corolla lobes varying from slightly longer than the throat to distinctly shorter, and never even approaching in length the combined tube and throat. The discovery in Lower California of the pappose form above described, otherwise indistinguishable from typical *B. dissecta* except by its imperfectly and perhaps abnormally disciform heads and more definitely hispidulous achenes, shows conclusively that the genus *Amauriopsis* cannot be maintained as distinct from *Bahia*. The squamellae in var. *anisopappa* are mainly scarious when small, but when better developed possess a callous midrib continued into the short awn. The achenes in the typical form are described by Rydberg as glandular-puberulent, but are normally so obscurely so as to appear essentially glabrous. The presence of much better developed hairs on the achenes of var. *anisopappa* is no doubt correlated here, as frequently elsewhere in Asteraceae, with the development of a pappus.

Dyssodia tephroleuca Blake, sp. nov.

Suffrutescens ca. 20 cm. alta pluricaulis, ramis involucrisque dense albotomentosis, foliis et caulibus griseo-tomentosis; folia omnia alterna linearifiliformia integra ca. 1 cm. longa 0.3 mm. lata; capitula solitaria breviter pedunculata radiata aurea; involucri 6.5–8 mm. alti phyllaria ca. 13 paene ad apicem connata pauciglandulosa, basi bracteolis ca. 8 anguste linearibus apice patentibus involucro demidio brevioribus; achenia parce hispidula; pappi paleae 10 subaequales 3–5-aristatae.

Root about 1 cm. thick, vertical; main stems apparently spreading, about 20 cm. long, woody toward base, griseous-tomentose, bearing numerous mostly simple erectish leafy 1-headed branches about 10 cm. long, these slender, densely white-tomentose; leaves erectish, rather flaccid, mostly 8–13 mm. long, 0.3–0.7 mm. wide, obtuse, usually minutely apiculate, sulcate above, rounded beneath, bearing about 10 scattered or usually subopposite yellow glands; peduncles erect, naked or few-bracteate, mostly 7–15 mm. long, densely white-tomentose; heads about 12 mm. wide; involucre campanulate, 4–5 mm. thick, the bracteoles obtusish, 1–3-glandular, the proper phyllaries bearing a pair of yellow glands a little below the apex of the connate portion, the free teeth narrowly triangular, acutish, 1.5–2 mm. long, bearing a single gland usually near the base; rays about 12, golden-yellow, the tube glabrous, about 2 mm. long, the lamina oblong-oval, about 5 mm. long, 2.5 mm. wide, 2–3-denticulate, 6–7-nerved; disk flowers numerous, their corollas golden-yellow, 4.2–4.8 mm. long, minutely hispidulous toward base of throat (tube 1 mm., throat slender-funnelform, 2.6–3 mm., teeth ovate, 0.5–0.8 mm. long, with a minute inflexed tooth at apex); achenes

[5] Proc. Amer. Acad. 19: 28. 1883, as *Bahia chrysanthemoides*.
[6] N. Amer. Fl. 34: 32. 1914.

very slender, black, multistriate, sparsely hispidulous, 4 mm. long, 0.4 mm. wide; pappus 4–4.5 mm. long, of 10 nearly equal essentially 1-seriate paleae, their oblanceolate paleaceous base 0.5–1 mm. long, the central awn firm, subterete, yellowish, hispidulous, 3–3.8 mm. long, the 2 lateral awns broader, whiter, subscarious, hispidulous on margin, undivided or split for ⅔ their length or less into 2 unequal awns; style appendages deltoid, finely hispidulous, short-cuspidate.

TEXAS: Eight miles north of Rio Grande City, Starr Co., 30 Aug. 1932, *Elzada U. Clover* 1825 (type no. 1,623,834, U. S. Nat. Herb.; dupl. in herb. Univ. Michigan).

Nearest *Dyssodia setifolia* (Lag.) Robinson, but well distinguished by its undivided leaves, much larger involucre, and very different pappus.

Dyssodia bracteata (S. Wats.) Blake.

Pectis bracteata S. Wats. Proc. Amer. Acad. **25**: 155. 1890.
Leucactinia bracteata Rydb. N. Amer. Fl. **34**: 180. 1915.

Specimens (nos. 5530, 5743, 5778) collected by C. L. Lundell at Charcas, San Luis Potosi, Mexico, in July-August 1934 agree perfectly with the type collection, *Pringle* 2403, from calcareous hills at Carneros Pass, Coahuila, which is apparently the only collection of this species hitherto made. It is difficult to understand how Dr. Rydberg was led to establish the new genus *Leucactinia*[7] for the reception of this species. Its long style branches, of course, prevent its reference to *Pectis*, but the principal character on which it was distinguished as a genus is mistaken. In his key (p. 148) Rydberg placed it next to *Chrysactinia* in the group with "pappus of numerous distinct bristles only" (as opposed to the genera with "pappus at least partly squamellate"), and in his generic character described it as with "pappus simple, of 10–20 scabrous bristles." In the specific description, however, he called the pappus bristles "slightly dilated and linear-subulate below." Watson had previously described them as "narrowly paleaceous toward the base." The members of the pappus can, in point of fact, be described about equally well as paleaceous-based bristles or as aristate squamellae; they cannot properly be called scabrous bristles. I find them to be about 12–18 in number, indistinctly 2-seriate, the inner longer and with a linear to lanceolate paleaceous base 1–1.5 mm. long, its thickened costa passing gradually or abruptly into a hispidulous bristle about 3–3.5 mm. long, the outer shorter (about 3 mm. long) and with narrower or obsolescent paleaceous border. The species can be received without difficulty into the rather multiform genus *Dyssodia*. The 1 or 2 pairs of short lobes with setaceous-subulate tips found near the base or sometimes near the middle of some of the larger leaves were overlooked by Rydberg, although mentioned in the original description.

[7] N. Amer. Fl. 34: 180. 1915.

Pectis propetes var. **holochaeta** Blake, var. nov.

Folia usque ad apicem setoso-ciliata (setis 14–24-jugis).

MEXICO: On plain, Acatitlan, Dist. Temascaltepec, State of Mexico, 23 Sept. 1933, *G. B. Hinton* 4797 (type no. 1,589,300, U. S. Nat. Herb.); on prairie, Limones, same District, alt. 910 m., *Hinton* 2509 p. p. (mixed with *P. saturejaoides* (Mill.) Sch. Bip, the latter in two forms); on plain, Cutzamala, Dist. Coyuca, Guerrero, 11 Aug. 1934, *Hinton et al.* 6422.

In typical *Pectis propetes* Greenm., still known only from the type collection (*Rose* 2436, from near San Juan Capistrano, Zacatecas), the leaves have only 5–9 pairs of setae, usually borne much below the middle of the leaf, rarely extending a little above the middle. This sort of difference usually indicates specific diversity in the genus, but in this case it is supported by no other clear distinctions. In *P. propetes* the stems become somewhat diffusely branched, and the first one appears to be erect; in var. *holochaeta* there appears to be no erect first stem, and the usually several procumbent stems are simple or subsimple. In *P. propetes* the achenes are rather uniformly and not very densely short-pilose with hairs about 0.5 mm. long; in var. *holochaeta* they are much more densely pilose with hairs about 1 mm. long, usually borne in one or two broad lines with essentially glabrous interspaces. Without knowledge of the amount of variation to which *Pectis propetes* may be subject, it seems advisable to consider all these differences as of only subordinate importance.

Pectis linifolia var. **hirtella** Blake, var. nov.

Involucri phyllaria dorso subdense hirtella; folia majora setis 2–3-jugis 4.5–6.5 mm. longis donata (jugis 1–2 basalibus, 1 infra medium folii).

MEXICO: On hill, Tanganhuato, Dist. Coyuca, Guerrero, 18 Sept. 1934, *G. B. Hinton et al.* 6606 (type no. 1,589,311, U. S. Nat. Herb.).

The type, a considerably branched plant about 7 dm. high, differs from all the numerous specimens of *Pectis linifolia* L. examined from Arizona, Mexico, West Indies, and South America in its hirtellous involucres and in the very long and slender purple setae of the leaves. The involucre of *P. linifolia* is described by Fernald and by Rydberg as glabrous or minutely puberulent, but is glabrous in all the specimens I have examined; and the setae are always basal, 1 or sometimes 2 pairs, rarely none, and only about 1–2 mm. long.

Liabum longifolium (Rusby) Blake.

Munnozia longifolia Rusby, Bull. Torrey Club **54**: 313. 16 May 1927.

Liabum hexagonum Blake, Journ. Washington Acad. Sci. **17**: 300. 4 June 1927.

Both these specific names were based on the same collection, *Buchtien* 3079 from Unduavi, Bolivia.

Cirsium trachylomum Blake, sp. nov.

Glabrum subvalidum valde erecto-ramosum capitulis numerosis; folia

principalia oblonga alte pinnatifida sessilia breviter decurrentia apice acuminata subcoriacea pallide viridia, lobis ca. 5-jugis lanceolatis v. oblongis acuminatis subintegris v. parum repando-dentatis margine rigide spinosis et spinulosis, spinis albidis ca. 5 mm. longis; capitula majuscula sicc. campanulata ca. 4.5 cm. alta irregulariter racemosa (1–6 per ramum) in pedunculis nudis v. bracteatis saepius 4–15 cm. longis; involucri basi vix umbilicati paucibracteati (bracteis spinoso-dentatis involucrum vix aequantibus)ca. 7–8-seriati valde gradati ca. 3 cm. alti phyllaria omnia erecta v. subappressa in margine plusminusve lutescenti-indurata et dense ciliolata, exteriora triangulari-lanceolata ad apicem breviter subherbacea spina rigida erecta ca. 2 mm. longa donata, media ovato-lanceolata v. lanceolata spina 2–4 mm. longa erecta donata, interiora (ca. 3–4-seriata) lanceolata-linearia acuminata in margine latiore dense et minute hispidula et ciliolata infra apicem breviter purpurascentia appendice subscariosa anguste triangulari integra minute ciliolata flavescenti-albida ca. 2 mm. longa donata; corollae purpureae, limbo tubo duplo longiore usque ad medium 5-fido, lobis obtusis ad apicem incrassatis; achenium maturum brunneo-nigrescens 4 mm. longum.

Plant essentially glabrous throughout, 1–1.2 m. high; stem pithy, striate, up to 1 cm. thick; leaves rather remote, the principal ones 13–21 cm. long, about 6–10 cm. wide, short-decurrent (wings 1–2 cm. long, lobed and spiny-toothed, 1–2.5 cm. wide including spines), light green on both sides, very slightly arachnoid toward base beneath, the lobes acuminate and spinose-tipped, about 2–4 cm. long and 1–2 cm. wide, entire or slightly sinuate-dentate or the lower 1–2-lobed on one side at base, not densely margined with slender prickles or small spines 1–3 mm. long and ending in firm slender spines 5–7 mm. long; upper and branch leaves smaller, dentate or shallowly lobed, not or scarcely decurrent; bracts of peduncles few, 2–6 cm. long, their basal teeth or spines enlarged; bracts subtending head narrowly lanceolate, 1.5–3 cm. long; outermost proper phyllaries about 1 cm. long, 2–3.5 mm. wide below, with indurated whitish or greenish-white base and lucid yellowish-white densely hispidulous-ciliolate margin about 0.3–0.5 mm. wide, above 1-ribbed (the rib sometimes glandular), sometimes 1–2-spinulose on each side below apex; middle phyllaries similar but broader (4.5 mm. wide), with 2–3 pairs of weak greenish ribs or nerves below apex, and with broader yellowish white margin (about 1 mm. wide); inner (3–4 series) with narrow greenish center (1–3-vittate) and broader, lucid, apparently viscid, densely and minutely hispidulous and ciliolate yellowish-white margin; whole involucre glabrous (except for the minute hispidity and ciliolation) or with the slightest trace of arachnoid tomentum on the margin of a few phyllaries; corollas 2.7–3.1 cm. long (tube 7–9 mm. long, throat moderately distinct, 9 mm. long, lobes linear, essentially equal, 11–13 mm. long, thickened at apex and often obtusely apiculate); achene glabrous, 4–5 mm. long; pappus whitish, 2 cm. long, the awns all plumose, about 10 of the inner with obscurely thickened tips; anther tips broadly triangular, shortly acuminate; style with obscure node.

LOWER CALIFORNIA: Granitic soil among pines along small canyon above a meadow, La Encantada, Sierra San Pedro Martir, alt. 2225 m. (7300 ft.), 18 Sept. 1930, *I. L. Wiggins & D. Demaree* 4904 (type no. 1,588,186, U. S. Nat. Herb.; duplicate in Dudley Herb. of Stanford University).

This species is not very closely allied to any hitherto reported from Mexico.

Its closest relationships are evidently with *C. andersonii* (A. Gray) Petrak, of California, and *C. rothrockii* (A. Gray) Petrak, of Arizona, from both of which it is entirely distinct.

Gochnatia cardenasii Blake, sp. nov.

Frutex parvus valde ramosus, ramulis compacte flavido-tomentellis foliosis; folia elliptica brevipetiolata ca. 8 mm. longa obtusa integra supra viridia subtus canescenti-tomentella anguste revoluto-marginata parum venosa; capitula 7–8-flora terminalia sessilia saepius solitaria mediocria; involucri 8–9 mm. alti phyllaria e triangulari-ovatis lineari-oblonga acuminata pubescentia.

Shrub "60 cm. high," the numerous straight rigid branches diverging at an angle of about 30–45°, the stem and older branches densely gray-tomentellous; leaves alternate, often with fascicles in their axils, the internodes mostly 5–10 mm. long; petioles 1–2 mm. long, canescent-tomentellous, slender, somewhat enlarged at base; blades elliptic or ovate-elliptic, 5–11 mm. long, 1.5–3.5 mm. wide, cuneate or rounded at base, coriaceous, above glutinous and essentially glabrous, obscurely triplinerved, the veins evident beneath under the tomentum; fruiting heads solitary or rarely paired at tips of stem and branches, usually subtended by 2 or 3 reduced leaves, sometimes with 1–4 abortive heads in the axils below them, when moistened cylindric and about 11–14 mm. high and 2.5 mm. thick; involucre strongly graduate, about 5-seriate, the phyllaries brownish, firm, ribless, ciliolate with partly glandular hairs, erectish-pilose, and somewhat sessile-glandular, glabrescent, the inmost almost cuspidate-acuminate; corollas apparently whitish, tubular, subcylindric, glabrous, 8 mm. long (tube 3 mm., throat 0.7 mm., teeth narrowly elongate-triangular, 4.3 mm. long, erect, 3-nerved, thickened inside at apex); achenes oblong, erectish-pilose, 3.5 mm. long; pappus yellowish-tinged, 9–10 mm. long, of numerous stiffish hispidulous graduated bristles; anthers 6.2 mm. long, including the hairy tails, these about 2.8 mm. long; style branches linear-oblong, 1.2 mm. long, erectish, obtuse, glabrous.

BOLIVIA: Quechisla, Dept. Potosí, alt. 3420 m., Dec. 1932, *M. Cárdenas* 326 (type no. 1,616,163, U. S. Nat. Herb.); Quechisla, Dec. 1931, *Cárdenas* 15 (Gray Herb.).

Readily distinguished among South American species by its yellowish-tomentellous branchlets and tiny bicolored leaves. The rather ample material is in good fruit, but the corollas have practically all fallen; only two perfect ones and an imperfect one could be found in the heads.

Chaptalia anisobasis Blake, sp. nov.

Basi rufo-tomentosa; folia oblongo-elliptica longe petiolata obtusa basi valde inaequalia tenuiter coriacea repanda supra citissime glabrata viridia subtus ochraceo-tomentosa; scapus ca. 25 cm. altus infra glabratus nudus ad spicem dense rufo-tomentosus et squamis paucis anguste triangularibus praeditus; involucri ca. 1.3 cm. alti phyllaria e oblongo-ovatis linearia obtusa; fl. fem. exteriores ca. 20 valde bilabiati involucro breviores, interiores minores etiam bilabiati; achenia immatura breviter rostrata puberula.

Root not seen; leaves 2 or 3 (or more?), apparently erect; petioles slender, naked except toward apex, thinly arachnoid-tomentose, glabrescent, 8–12.5 cm. long; blades oblong-elliptic or ovate-elliptic, or sometimes slightly wider

above the middle, 3.5–6.3 cm. long, 2–2.8 cm. wide, usually strongly inequilateral at base (usually subtruncate or slightly cordate on one side, subtruncate or obliquely curved on the other) and often very narrowly decurrent on apex of petiole for 1.2 cm. or less, shallowly repand chiefly below middle, very narrowly revolute-margined, featherveined, the lateral veins 4–6 on each side, scarcely prominulous above, evident through the wool beneath, the secondaries obscure; scape erect, 20–26 cm. high, slender, thinly arachnoid-tomentose and glabrate except toward apex, there very densely rufous-tomentose and bearing 3 or 4 very narrowly triangular or subulate bracts about 2.5 mm. long; head solitary, apparently nodding; involucre about 6-seriate, strongly graduate, the outer phyllaries oblong or ovate-oblong, obtuse, 1–1.5 mm. wide, the middle ones linear-oblong, 1.3–1.5 mm. wide, obtuse, the inner linear, about 1.5 mm. wide, obtuse or acutish, all with greenish center and purple subscarious margin; outer pistillate flowers about 16–21, essentially 1-seriate, their corollas bilabiate, white, somewhat purplish-veined, glabrous, shorter than the involucre (not fully developed?), erect, the tube 5 mm. long, the outer lip elliptic-linear, 3-denticulate, 4-nerved, 5.3 mm. long, about 1.5 mm. wide, the inner lip 2-parted to base, the divisions linear, obtuse, erect, about 1.2 mm. long; corollas of inner pistillate flowers bilabiate, glabrous, white, 6.4 mm. long, the tube 5 mm. long, the lips erect, the outer 3-lobed to below the middle (lobes narrow-triangular, with incurved blunt callous tips, the middle lobe 1.2 mm. long, the outer lobes 0.8 mm.), the inner of 2 similar lobes 1 mm. long; corollas of hermaphrodite flowers white, glabrous, bilabiate, 8 mm. long, the tube 3.5 mm. long, the throat 2 mm. long, the outer lip subequally 3-lobed to below the middle, the lobes triangular, at apex thickened and papillose inside, 1.5 mm. long, the inner lip of 2 similar lobes 2.5 mm. long; achenes (decidedly immature) subfusiform, short-beaked, somewhat puberulous, a few of the hairs with subglandular tips; pappus bristles numerous, yellowish-white, about 7.5 mm. long, finely hispidulous.

COLOMBIA: Páramos of the Sierra Nevada de Santa Marta, Dept. Magdalena, alt. about 3850 m., July 1932, *William Seifriz* 484 (type no. 1,572,393, U. S. Nat. Herb.).

Close to *Chaptalia meridensis* Blake, of Venezuela, in which the essentially symmetrical leaves are broadly oval, thicker, rather persistently arachnoid above or tardily glabrate, and on petioles only as long as the blade or shorter.

Microseris tenella var. **aphantocarpa** (A. Gray) Blake.

Calais aphantocarpa A. Gray, Proc. Amer. Acad. 6: 552. 1865.
Microseris aphantocarpa Schultz Bip. Pollichia **22–24**: 308. 1866.

Gray,[8] when transferring his *Calais tenella* (of 1857) and *C. aphantocarpa* (of 1865) to *Microseris*, regarded the former as merely a depauperate state of the latter, and adopted the name *aphantocarpa* for the specific concept on account of the inappropriateness of the name *tenella*. Schultz Bipontinus had earlier transferred these and other species described or listed by Gray in 1857 to *Microseris*, but his paper was overlooked by Gray and by most later authors. The earlier specific name, *Microseris tenella* (A. Gray) Schultz Bip., must of course be adopted for the species, and *aphantocarpa* treated as a variety.

[8] Proc. Amer. Acad. 9: 209. 1874.

ENTOMOLOGY.—*Some undescribed species of* Eristalis *from North America in the United States National Museum.*[1] FRANK M. HULL, University of Mississippi. (Communicated by HAROLD MORRISON.)

Eristalis aztecus n. sp.

Female: Face considerably projecting. Upper half brownish yellow, lower half and cheeks brownish black, shining; pile of face very long, yellow, of lower occiput, white; cheeks bare. Front and vertex dark brownish, more or less opaque, with dense, very long, reddish yellow pile. Eyes densely long pilose. First and second antennal joints shining brownish orange. Third joint more opaque, brownish orange below and black along a narrow dorsal border. Arista extends to facial knob, light reddish with long plumose hairs on basal half, very slightly and gradually thickened basally. Thorax dark brownish, opaque. Pleurae, same color, shining; scutellum brownish red, faintly shining. Pile of pleurae, thorax, scutellum, light reddish, tending to golden, very long and dense. Second abdominal segment black, faintly shining, an obscure, reddish shining spot, occupying either side. Third, fourth, and fifth segments shining black. Third with a narrow obscure opaque black band on anterior border and again just before posterior border. Pile of second segment abundant, long, very short on third and fourth, practically absent on fifth. Venter shining, the color is an indefinite mixture of light brown and black.

All femora shining, black, save at the tip, pale yellow. A single row of unusually long yellow bristles at regular intervals on the ventral side of hind femora. Pile long and black. Hind tibiae white on basal half. Middle tibiae save at tip, and fore tibiae on basal half pale yellow, otherwise dark brownish. Fore and middle tarsi light reddish; last two joints of fore and middle and all of hind tarsi dark brown. Wings quite hyaline. Stigma brown. Hind tibiae somewhat flattened; no ciliary brush. Length 14 mm.

The type is a female, no. 42076 U. S. N. M., Real del Monte, Mexico, 9,000 ft. (*H. T. Vanostand*).

This belongs to those neotropical species, strikingly similar to *Eristalis circe* Will., in the pronounced light reddish brown coloration and thick shaggy pile of similar color. The ground color of the face is light obscure brown, not shining black and the lower face projects forward less. The shaggy red pile of *circe* continues to the terminal abdominal segment, where as it is limited to the first and second in *aztecus* and grown noticeably shorter on the second.

It may be noted that this species resembles *fulvipes* Big. in the dilated posterior tibiae and the color of thorax, scutellum, and the pile; it differs in its very hairy eyes, plumose arista, etc. It must be close to Bigot's *E. inca*, in hairy eyes, plumose arista, and dark thorax covered with reddish pile. It differs in front being brown, not black, with thick long yellow hair and absence of long yellow hair on face. *Eristalis aztecus* traces to *distinguendus* in Curran's Key, differing markedly in color and pile.

[1] Received April 16, 1935.

Eristalis circe Will.

Male: Face considerably projecting downward; shining black, covered with very long, pale brownish yellow hair; cheeks bare, shining black. Vertex shining black, covered with similar hair to that on face, likewise covered with microscopic pubescence. Facial prominence inconspicuous. First and second joint of antennae black, shining. Third joint opaque light reddish brown. Arista lost. Eyes heavily long pilose; pile of lower occiput very shaggy, nearly white, upper occiput tending to reddish. Whole thorax opaque dark brown. Thorax, scutellum and pleurae, densely covered with long shaggy reddish yellow pile, tending to golden.

Abdomen light brownish red, second and third segments faintly shining, fourth quite shining. Second segment with a narrow black transverse band along anterior border, widening medially and becoming a median black spot pointed apically; third segment likewise with a median black spot; fourth with a still smaller black spot. Whole abdomen covered with exceedingly long reddish yellow pile. Venter entirely shining black. Hypopygium shining black. Fore and middle femora light yellow save tip, and hind femora shining black. First two femoral pairs with long black hairs. Last femora with long dense hairs arranged as a brush on outer and inner surfaces, the outer reddish yellow except on extreme tip and the inner black; bristles in bristle-row, yellow. Tibia black, basal half of first pair, basal two-thirds of second, yellow, shining. Fore and middle tarsi yellowish brown. Hind tarsi smoky brown to black. Wings hyaline, veins only with narrow reddish brown clouds, which are probably characteristic. Hind tibiae compressed, without ciliary band. Length 14 mm.

One male, Mexico City, Mexico (*Juan Muller*).

Eristalis fuliginosus n. sp.

Male: Face, cheeks, vertex, front, shining black; microscopic, silvery pile present on all these parts, but most abundant on lower face and cheeks, and here divided by a bare band of shining black; facial prominence large, though not especially prominent, bare. Face and cheeks with sparse, quite long silvery hair. Long black sparse hair on vertex and antennal prominence. Ocelli situated on a distinct prominence. Eyes heavily long pilose, especially anteriorly. Antennae dark reddish brown, microscopically pubescent; arista slender, not thickened, non-pubescent, wiry, light reddish in color. Third antennal joint about one and a half times as long as broad, somewhat pointed apically. Pleurae for most part shining black with sparse long black pile. Disc of thorax and scutellum opaque black, pile thick, but short, growing quite long on scutellar margin, black, center of scutellum with oval, median, opaque yellow spot barely touching posterior margin.

Abdomen black. Second segment opaque, save posterior margins and lateral margins narrowly. Third segment opaque save broad transverse shining black band, narrowly interrupted medianly. Fourth entirely shining; pile on margins of second segment and disc of second and third black, some white pile on disc of second only and on margin of third and fourth and hypopygium. Venter entirely black. All the femora shining black, long black pilose, hind femora heavily thickened; all tibiae shining reddish brown, all tarsi reddish orange brown; pile of tibiae and tarsi light; hind tibiae prominently flattened, a groove on inner surface of apical half. Wings smoky brown on outer half, hind tibiae without ciliary brush. Length 12 mm.

Holotype male, no. 42078 U. S. N. M., Attenas, Costa Rica (*Schild and Burgdorf*).

This species is similar to *nigripennis Macq.* in the dark coloration, and the smoky wings of the apical half. Distinctive in the yellow spot on scutellum, which is opaque, and the heavily thickened, 'pinched-in' hind femora with glossy brownish red tibiae. The above characteristics likewise distinguish it from the neotropical *Eristalis scutellaris* Fabs. to which it is allied by the slender, bare, quite long arista. The front in profile is peculiarly flattened.

This traces to my species *Eristalis cyatheus* in Curran's key, but the thoracic pattern is not broken up into spots as in that species. From *precipuus* Will., also with red femora and tibiae it is distinguished by the black color of the abdomen. *Eristalis melanaspis* Wied. has a yellow abdomen and its scutellum is similar to this species, but its femora are dark.

Eristalis bistellatus n. sp.

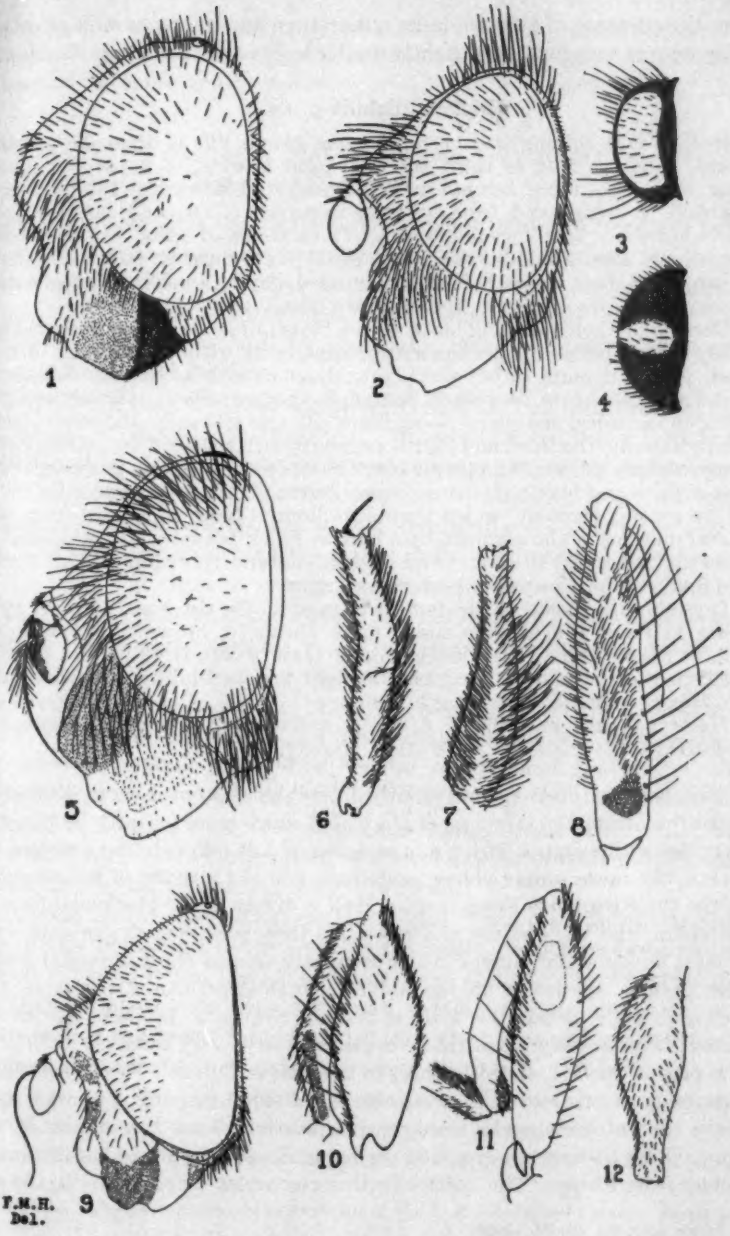
Female: Cheeks black, covered with faint white pruinescense and abundant long yellow hair; a bare spot in middle of face just above mouth, oval in shape and shining yellowish brown. A similar bare spot just above antennae. First joint of antennae yellowish brown, shining, remainder wanting. Front dark brown becoming nearly black at vertex; pile thick and lighter brown in color. Eyes densely pilose save on a narrow posterior strip.

Thorax and scutellum opaque velvety black, pile very thick and black. Scutellum equipped with an extra long tuft of pile on each side near the base. Remainder of scutellar margin bare. First abdominal segment black, opaque, with long whitish pile. A large, nearly square, opaque, pale yellow spot on each side of second segment, narrowly separated by black in the middle. Third segment opaque black, fourth segment similar, except for a transverse band in middle of segment, shining black and narrowly interrupted medianly. A similar uninterrupted band on fifth segment. Pile of abdomen, save on fifth segment short, thick, close, black; on fifth segment it takes the form of very long indefinite median, posterior, and lateral tufts. Second segment of venter light yellow with dark brown median spot. Third brownish black, yellowish in anterior lateral angles. Pleurae opaque black, densely black pilose. All the femora, shining black, densely black pilose, the basal half with some sparse, very long pale pile. Middle femora on posterior ventral side with a long brush of exceedingly dense, long black pile. Anterior tibiae shining reddish brown; hind tibiae shining black, quite flattened and with black ciliary brush on dorsal and vertral surfaces. All the tarsi reddish brown, pile golden; hind metatarsus enlarged. Wings hyaline, faintly brownish. Length 16.5 mm.

Type, a female, no. 42079 U. S. N. M., Piches and Perene, Peru, 2000–3000 ft. altitude.

This species is related to *Eristalis pygolampus* Wd. in the large size, dark color, and broad, flat, dark scutellum, but differing in the less metallic abdo-

Fig. 1.—Lateral view of head of *Eristalis bistellatus* n. sp. Fig. 2.—Lateral view of head of *Eristalis circe* Will. Fig. 3.—Scutellum of *Eristalis diabilis* n. sp. Fig. 4.—Scutellum of *Eristalis fuliginosus* n. sp. Fig. 5.—Lateral view of head of *Eristalis aztecus* n. sp. Fig. 6.—Figure of posterior tibiae from the side of *Eristalis bistellatus* n. sp. Fig. 7.—Figure of femora of *Eristalis aztecus* n. sp. Fig. 8.—Lateral view of hind femora of *Eristalis aztecus* n. sp. Fig. 9.—Lateral view of head of *Eristalis fuliginosus* n. sp. Fig. 10.—Lateral view of posterior femora of *Eristalis fuliginosus* n. sp. Fig. 11.—Lateral view of hind femora of *Eristalis diabilis* n. sp. Fig. 12.—Dorsal view of hind femora of *Eristalis fuliginosus* n. sp.



For explanation of Figs. 1–12, see bottom of opposite page.

men, the presence of the two large quadrate yellow spots, as well as other differences as described. It is slightly similar to *Eristalis surinamensis*, Macq.

Eristalis diabilis n. sp.

Male: Front shining and vertex opaque black. Pile of these areas very sparse, about as long as third antennal joint is wide, of a vitreous black color. Face descending, but not markedly and a median stripe shining vitreous black. A broad band, from epistoma to margin of eyes and thence to just above antennae, of silvery pubescence. The same band bears very scattered, long silvery hair. First and second antennal joints shining black; third dark brown, very short instead of evenly rounded, having an obliquely truncated appearance. Eyes dichoptic, thinly brown pilose.

Dorsum of thorax shining black with a bluish tinge, the color obscured by thinly dusted pollen (or pruinescence), apparently without markings of any kind. Pile of dorsum rather abundant, about as long as half the length of scutellum, pale brownish yellow. Scutellum opaque yellow, narrowly opaque black on the sides, pile sparse, long, black. Pleural pile pale. Abdomen black, faintly shining, the third and fourth segments with a central transverse band more strongly shining. An opaque black band on anterior and posterior margins of third and fourth segments; a pale brownish yellow spot on either side of the second segment, wider than scutellum is long, separated from the lateral margins of the segment by a narrow black border which widens as it proceeds posteriorly to about twice its width anteriorly. Segments two, three, and four with narrow yellow posterior margins.

Legs shining black. All the femora normal at the tip, basal third of hind tibiae and fore and middle tibiae more normally, brownish or brownish yellow. Fore and hind tarsi black; middle tarsi brown. Hind femora slightly thickened in the middle, producing a slight 'pinched-in' appearance at the tip. Wings quite hyaline. Length, 8 mm.

Holotype male, no. 42077 U. S. N. M., and one paratype male, Tacubaya, and Mexico City, Mexico, 4–18 (*John Muller*).

This peculiar little species greatly resembles the one I have discussed[3] under the name of *quadraticornis Macq.* and which more recently Dr. Curran identifies with *meigenii* Wd. From *meigenii* Wd. it differs in the unicolorous thorax, the more widely yellow scutellum, and the absence of yellow spots on the third segment. From *texanus* Hull it differs in the blackened base of scutellum, and the absence of stripes. All three species are quite small and at least *meigenii* Wd. agrees in the peculiarly shaped third antennal joint. The present species is unique among North American *Eristalis* in the dichoptic male, unless the male of *texanus* proves to be dichoptic which seems likely. *E. meigenii* might be considered to be very narrowly dichoptic. The present species, *diabolis*, traces to *meigenii* in Curran's Key, but is more dichoptic, and moreover, *diabolis* also has a small, shining, yellowish spot above the antennae, and a transverse depression about the middle of the front. Older authors have applied the name *Eristalinus* to similar dichoptic species from Europe. The species further resembles *meigenii* Wd. in the pe-

[3] Ohio Jour. Sci. 25: 29. 1925.

culiar type of third antennal joint, in size, bimaculate scutellum and general pattern of abdominal markings. The thorax is unicolorous, however, and the scutellum more widely yellow.

GEOLOGY.—*Tentative ages of Pleistocene shore lines.*[1] C. WYTHE COOKE, U. S. Geological Survey.

For countless ages the relative positions of land and sea have been continually changing. Vast areas that are now dry land are floored by rocks deposited in ancient seas. Many continents and islands are fringed by marine terraces that have more recently emerged and whose shore lines can still be traced by means of their abandoned beaches and other features.

It has been the custom in the past to call such emerged beaches and sea bottoms "raised" or "uplifted," the implication being that they attained their present position above sea level by rising or tilting of the land while sea level, the datum plane to which they are referred, remained constant. Although it is undoubtedly true that the emergence of such features in many places is due primarily to movements of the land, yet these very movements must have affected the level of the sea. If upwarp of the crust of the earth at one place is compensated by downwarp elsewhere, the net effect of crustal movements on sea level is nil, provided that all parts affected are beneath the sea or all are above sea level; but if the land rises and the sea bottom sinks, sea level falls; and if the land sinks and the sea bottom rises, sea level becomes higher. The crustal movements that raised the Pacific coast of the Americas and formed the near-by deeps probably resulted in a world-wide lowering of sea level. It seems likely that the dominant direction of change of sea level due to crustal movements during Quaternary time has been downward.

Another factor that influences the height of sea level is the variable size of the polar and subpolar ice caps. This factor has been called glacial control. When the ice caps are large there is less water in the sea than when the ice caps are small. Glacial stages, therefore, are times of low sea level; interglacial stages are times of high sea level. As the earth is now in a state of partial glaciation, the height of sea level due to glacial control is intermediate between the lows of the glacial stages and the highs of the interglacial stages.

As water seeks its level, a variation in the capacity of the oceanic

[1] Published by permission of the Director of the U. S. Geological Survey. Received May 11, 1935.

basins due to crustal movements or a variation in the amount of water in the oceans due to glacial control produces a world-wide change in the level of the sea. An abandoned shore line in China should stand at approximately the same height as the contemporaneous shore line in Virginia, provided that there have been no crustal movements at either place and disregarding local variations in sea level. Exact correspondence in the levels reported is not to be expected because the measurements are usually made to the abandoned high-tide mark, which varies considerably in height from place to place. With these limitations, it is therefore possible to correlate marine terraces in many parts of the world simply by ascertaining the altitudes of their abandoned shore lines with respect to the present sea level.

It may also be possible to correlate the marine terraces with the sequence of glacial and interglacial stages in North America on the assumption that the oscillations of sea level are due primarily to glacial control. On two previous occasions I have applied this principle in the preparation of correlation tables.[2] The speculative nature of these correlations was emphasized in both papers and it was frankly stated that they could scarcely be expected to prove final. The first attempt was defective because the sequence of shore lines then known was not complete; the second was not acceptible to glacialists because it assumed three interglacial substages within the Wisconsin. Both were incorrect because they were based upon the erroneous assumption that each shore line represents a different interglacial stage or substage.

That this assumption is false appears to be proved by the observations of Stearns[3] on the island of Oahu. He finds that sea level dropped from about 95 feet above its present level to 70 feet and then to 40 (?) feet without the intermediate lower levels that would be expected if each of these highs represented a different interglacial stage. From 40 feet the water sank to about 60 feet below the present sea level and then rose to 25 feet above it. It seems reasonable to suppose that this low level represents a glacial stage and that the 95-, 70-, and 40-foot levels together represent one interglacial stage.

Corroboration of the existence of a low stand of sea level preceding the 25-foot stand is found on the Neuse River 10 miles below New Bern, N. C., where Mansfield[4] reports large truncated cypress stumps

[2] COOKE, C. W. *Correlation of coastal terraces.* Jour. Geology **38**: 577–589. 1930; *Tentative correlation of American glacial chronology with the marine time scale.* This JOURNAL **22**: 310–312. 1932.

[3] STEARNS, H. T. This JOURNAL **25**: 90. 1935.

[4] MANSFIELD, W. C. U. S. Geol. Survey Prof. Paper **150**: 134. 1927.

overlain to a height of 26 feet above sea level by sand and clay containing brackish-water shells. An indication that there were probably no intermediate low stands of the sea immediately preceding the 70-foot and the 42-foot stands is suggested by the shape of the shore lines at those levels in South Carolina.[5] These shore lines seem to indicate emergence rather than submergence. An indication that sea level was low before the 100-foot stand is found at Washington, where the Wicomico formation, there presumably of estuarine origin, rests upon cypress stumps that grew about 60 feet below the Wicomico shore line.[6]

The accompanying revised correlation table is still highly speculative. It is still probably defective in many respects, but it is believed to be somewhat closer to the truth than the two previous attempts. The "Princess Anne" terrace, which was credited with a shore line 12 feet above sea level in the second correlation table, is omitted in the new version because I have been unable to confirm the existence of a shore line at that level in South Carolina, where the conditions for its preservation are favorable and where large-scale topographic maps should make its detection easy.

TABLE 1.—TENTATIVE AGES OF PLEISTOCENE TERRACES

Approximate altitude of strand lines		Name of terrace in the southeastern United States	Glacial and interglacial stages
Feet	Meters		
		.....	Nebraskan glacial stage
270	82	Brandywine	Aftonian interglacial stage
?	?	.....	Kansan glacial stage
215	66	Coharie	Yarmouth interglacial stage
170	52	Sunderland	
?	?	.....	Illinoian glacial stage
100	30	Wicomico	Sangamon interglacial stage
70	21	Penholoway	
42	13	Talbot	
?	?	.....	Iowan glacial stage
25	8	Pamlico	Peorian interglacial stage
		.....	Wisconsin glacial stage

[5] COOKE, C. W. *Geology of the Coastal Plain of South Carolina.* U. S. Geol. Survey Bull. (in course of publication).

[6] WENTWORTH, C. K. *The fossil swamp deposit at the Walker Hotel site, Connecticut Ave. and DeSales St., Washington, D.C.* This JOURNAL 14: 1–11. 1924.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

BOTANICAL SOCIETY

265TH MEETING

The 265th meeting was held at the Kennedy-Warren Apts., April 2, 1935.

Program: WM. H. WESTON, JR.: *Recent advances in our knowledge of the sexuality of certain lower fungi.* Since Blakeslee in his epoch-making paper of 1904 first recognized, demonstrated, and defined heterothallism in the Mucorales, the experimental period in the study of sexuality in the fungi which he ushered in has been notable chiefly for the discovery of this condition by other workers, not only in other groups of Phycomycetes but also in the Ascomycetes and Basidiomycetes. Recently, however, a much more complex sexual condition of hermaphroditism involving self sterility with cross fertility toward compatible opposites has been found to obtain in certain Ascomycetes and has been worked out in detail in *Sclerotinia*, where the ascospores are uninucleate and there is a consequent segregation of compatibility or fertility therein; and in *Pleurage*, where the normal binucleate ascospores involve the somewhat more complex situation of the presence in the same binucleate spore of two hermaphroditic entities, each self sterile but reciprocally cross fertile. This condition is much more complex than either the homothallism or heterothallism recognized by Blakeslee, as each individual is not one single separate sex, either male or female exclusively, but is hermaphroditic with highly specialized and differentiated male and femal sex organs and a definite self sterility and cross fertility, the situation on the whole resembling that in some of the flowering plants.

This illuminating condition found in the Ascomycetes is of course too complex to cast any light on the more primitive condition from which these more elaborate ones have evolved. As might be expected, we must turn for such primitive phylogenetically significant situations to the aquatic Phycomycetes. Here Kniep, in *Allomyces javanicus*, has found a condition more primitive and hence probably of more phylogenetic significance, a condition of hermaphroditism with self fertility between heterogamous planogametes distinctively different in size, color and activity and borne in definitely arranged gametangia, notably dissimilar in size and shape. This interesting condition has been corroborated by Hatch in *A. arbuscula* and by Emerson and Weston in other tropical species of the genus. The situation presents a close parallel to that revealed by recent studies in the green algae and is of interest in bridging the gap between the isogamous planogametic fusions in some of the Chytridiales and the hitherto anomalous situation of oogamy in *Monoblepharis* involving large non-motile eggs and small motile sperms.

Of the several examples considered in this discussion these two, at least, give the impression that far more significant and interesting sexual conditions are to be found in the lower fungi than might have been expected from consideration of the classic situations defined as heterothallism and homothallism by Blakeslee thirty years ago.

SPECIAL MEETING

A special meeting was held April 24, 1935, in the Auditorium of the U. S. Department of Agriculture, President WM. W. DIEHL presiding.

Program: L. O. KUNKEL.—*Plant viruses* (illustrated). Some recent ad-

vances in studies on plant virus diseases have been made possible by the discovery that primary lesions are produced by the virus of tobacco mosaic and by many other viruses, that large numbers of closely related strains of viruses are prevalent in nature, and that any one strain of a virus protects against other strains of the same virus, but not against any other virus.

Necrotic primary lesions produced by the virus of tobacco mosaic on leaves of *Nicotiana glutinosa* and *Phaseolus vulgaris* are conspicuous and easy to count. The number of lesions that appear following inoculation with any sample of virus furnishes a measure of the infectivity of the sample, and therefore indicates the concentration of virus in the sample. This method of measuring concentration facilitates quantitative studies on the tobacco-mosaic virus. By choosing appropriate test plants, the method becomes applicable for quantitative studies on a considerable number of other plant viruses.

Many different plant virus diseases have been recognized and studied. The several diseases have usually been distinguished by characteristic symptom differences. The discovery that a large number of different strains of tobacco-mosaic virus may be isolated from bright yellow spots that occur on the leaves of plants having ordinary tobacco mosaic, and similarly that yellow strains of cucumber mosaic may be isolated from plants having ordinary cucumber mosaic, has focused attention on virus relationships. Recognition of these relationships has simplified certain virus disease problems.

Tobacco plants infected with any one of a large number of different strains of tobacco-mosaic virus become immune from other strains of this virus. They are not immune from cucumber-mosaic virus, or from other viruses to which tobacco plants are susceptible. Similarly, tobacco plants infected with any one of several different strains of cucumber-mosaic virus become immune to other strains of this virus, but are not immune from tobacco-mosaic virus, or from other viruses to which tobacco is susceptible. The immune reaction is specific and furnishes a dependable means for the identification and classification of plant viruses and the diseases they produce. Little is known regarding the nature of immunity from virus diseases acquired by plants, but the discovery that peach-yellows virus in diseased peach trees can be destroyed by heat treatment that does not injure the trees has furnished favorable material for further work on this phenomenon. (*Author's abstract.*)

EARL B. MCKINLEY.—*Animal viruses* (illustrated).

266TH MEETING

The 266th regular meeting was held in the Assembly Hall of the Cosmos Club, May 7, 1935, President DIEHL presiding; attendance 75. The following were elected to membership: CORABEL BIEN, ARNOLD S. DAHL, JUAN B. DEMAREE, LORENZO D. EAGLES, CHARLES R. ENLOW, LEWIS A. FLETCHER, D. VICTOR LUMSDEN, EUGENE MAY, MAX A. MCCALL, ELIZABETH R. PENDLETON, SHIO SAKANISHI, DEAN R. WICKES.

Program: ANNIE M. HURD-KARRER.—*Plant physiology involved in the problem of the selenium disease of livestock.* Sulphur or sulphate applications to soil containing selenium so reduced the amount of selenium entering wheat plants as to render their grain non-toxic to rats, the selenized control plots without sulphur yielding toxic grain which produced the typical selenium disease on the rats of parallel feeding tests. Other factors influencing selenium absorption by wheat were type of soil and form of selenium. The selen-

ates are more toxic than the selenites, and of the former, the potassium salt was invariably less toxic than those of sodium and calcium. The selenates produce a white chlorosis and pink coloration of the leaves. The selenites on the other hand do not ordinarily produce this chlorosis, but often cause the roots to become reddened. The theory is advanced that the selenites are the more easily reduced in the root, borne out by the fact that more selenium gets into the tops in the case of the selenates. Plants with a high sulphur requirement, notably the Cruciferae, take up the most selenium, and those with the lowest sulphur requirement, certain of the Gramineae, absorb the least. Other crops tested were intermediate, the rate of absorption of the two elements varying together. A theory is proposed to explain the quantitative aspects of the selenium-sulphur antagonism, which suggests the possibility that the toxicity of a non-essential element may in general be conditioned by the relative availability of an essential element sufficiently similar chemically to permit substitution in some synthesized compound and to preclude discrimination by the root. (*Author's abstract.*)

J. E. McMURTREY.—*Distinctive effects of deficiency of certain essential elements on the growth of tobacco plants.* This is a report of the distinctive deficiency effects of N, P, K, Mg, Ca, B, S, Fe and Mn on the growth of tobacco plants. A deficiency of nitrogen is shown by the whole plant assuming a light green color, with more or less yellowing and drying up or "firing" of the lower leaves to a light brown color. A shortage of phosphorus on the contrary, produces a plant that is abnormally dark green in color with in some instances a yellowing or drying up of the lower leaves to a greenish brown to black color. A shortage of potassium and magnesium in contrast with nitrogen and phosphorus deficiency results in localized effects, with chlorosis of the lower leaves as the dominant characteristic. Typical potassium hunger is distinguished from magnesium hunger by the appearance of small necrotic spots or specks at the tips and margins of the chlorotic leaves in the case of the former. In contrast with the deficiency effects of the above elements which are general or occur on the older or lower leaves, are those typically occurring on the new growth or bud leaves and caused by deficiency in Fe, Mn, S, B, or Ca. A deficiency of Fe, Mn or S produce characteristic chlorosis on the younger leaves. The chlorosis resulting from shortages of Fe or Mn resemble each other in that the veins tend to retain their green color but in the case of the latter a necrotic spotting occurs scattered over the leaf which is not true with Fe chlorosis. The chlorosis resulting from S deficiency differs from those just mentioned in that the veins are lighter green in color than the tissue between the veins. A shortage of Ca first becomes apparent as a peculiar hooking downward of the tips of the young leaves composing the bud, followed by a breaking down of these leaves at the tips and margins. If later growth takes place, the tips and margins show a cut out appearance. In contrast with these effects, a deficiency of boron produces a light green color at the base of the young leaves of the bud, followed by a breakdown, which, if not too severe is followed by later growth, thus causing the young leaves to become distorted or twisted at their bases. The tip of the leaf usually remains alive for some time after the base has broken down. The final result with extreme shortages of boron and calcium is the death of the terminal bud. The foregoing contrasts have served as a basis for the construction of a key to the deficiency effects studied. (*Author's abstract.*)

M. A. RAINES.—*Some experiments with roots.* The elongation of the young

radicles of many plants varies consistently, and under many environmental conditions quite sensitively. The amount of elongation (conveniently expressed as a ratio comparative to the elongation in water-saturated air, as a readily reproducible control condition) promises to have value in descriptions of and specifications for environmental conditions and root-environmental relationships. Radicles for test purposes are obtained by germinating seeds on strips of blotting paper which are suspended in a moist chamber, with the upper ends of the strips dipping into a water trough, so that they are kept moist by capillarity downwards. The seeds are held in position on the strips of blotting paper by means of pieces of wet absorbent tissue paper. Representative data are given of the elongation ratios of the radicles of lentil, tomato, squash, cress, green pea, and wheat under a variety of common experimental conditions. Test interval, 24 hours; volume of test solution 10 ml. per radicle. Disturbances were regularly caused in the elongation of some radicles (notably lentil, tomato, squash, cress, by such substances as "vaseline," paraffine, and white mineral oil coming into contact with the water in which the roots were growing. Other substances found to cause disturbances in root elongation were lubricating oils, waxes, asphalt, resins, metals, and plant products such as sawdust. In addition, the roots were affected in their growth by the *vapors* given off at ordinary room temperatures (25°C ± 5°) by paraffine, "vaseline," mineral oils, and various waxes present in an enclosed space in which the roots were growing, but not in contact with the water containing them. In experiments on the significance of the difference in the elongation of the radicles in water and in the moist chamber, it was found that the smaller the amount of water used per radicle, the closer does the elongation of the root approach that in the moist chamber. This is interpreted as indicating the exertion of a conditioning influence by the growing root on the water around it; and that, in the case of the radicle growing in the moist chamber, it is growing not in air but in a thin film of water which is in equilibrium with the root in the matter of such conditioning influences. (*Author's abstract.*)

CHARLES F. SWINGLE, *Recording Secretary.*

SCIENTIFIC NOTES AND NEWS

Prepared by Science Service

NOTES

Army Medical Research Board.—The transfer of the Army Medical Research Board from Manila, P.I., to Ancon, C.Z. has recently been effected. The Research Board was organized in Manila in 1900, with LIEUT. RICHARD P. STRONG, Medical Corps, now head of the School of Tropical Medicine, Harvard University, as its first president.

The activities of the board in Manila included research and investigations largely in the field of tropical medicine, particular attention being paid to the dysenteries, cholera, plague, yaws, dengue fever, malaria, filariasis, beriberi, surra and rinderpest. The latter two are diseases of animals. The contributions of the board are too numerous to mention here, as the bibliography includes over 150 titles of scientific articles published in various journals and books.

It is believed that at this time the Canal Zone offers a more promising opportunity for the board than the Philippine Islands. In the Canal Zone

the board will initiate its work with investigations relative to the epidemiology and control of malaria beyond the limits of the sanitated area—an extremely important problem to the Army during tropical maneuvers and campaigns.

It has been recognized for many years that several fevers of short duration, but a fruitful source of incapacity, identical with or closely resembling denque and papatacci or sanifly fever are prevalent at certain seasons in the Canal Zone. The board will also make an effort to identify these fevers with a view to their prevention or abatement in the future. Mycotic skin diseases are extremely common in Panama and a study and investigation of these ubiquitous dermatoses are under way.

Bureau of Fisheries.—At the Chicago meeting of the National Planning Council of Commercial and Game Fish Commissioners, Commissioner FRANK T. BELL outlined plans which he has formulated for cooperation between the Commission, as representative of the Federal Government, and the several States. At the same meeting, TED LITTLE, of the Bureau, was elected secretary of the Council. GLEN C. LEACH, ELMER YIGGINS, TALBOTT DENMEAD and R. H. FIEDLER took part in the proceedings of the meeting.

Commissioner BELL addressed the recent meeting of the Izaak Walton League of America in Chicago, on problems of protecting the salmon fishery of the Columbia river.

In response to a general demand on the part of the public, the Bureau of Fisheries aquarium in the Department of Commerce Building is to be kept open on Sundays during the summer and as long thereafter as attendance warrants. The hours are from 10 in the morning until 4:30 in the afternoon.

ROBERT O. SMITH, of the Bureau's oyster investigation staff, left Washington recently to assume his new duties at Appalachicola, Florida, where he will have charge of oyster pest control investigations in the Gulf area.

National Bureau of Standards.—The honorary degree of Doctor of Engineering was conferred upon DR. LYMAN J. BRIGGS, Director of the National Bureau of Standards, by the South Dakota State School of Mines, Rapid City, S.D., on May 30. DR. BRIGGS delivered the baccalaureate address on the relation of the Bureau to engineering, and later proceeded to the stratocamp near Rapid City, where, as chairman of the advisory committee of the National Geographic Society-Army Air Corps stratosphere expedition, he supervised the final arrangements for the flight of the balloon, "Explorer II."

The John Price Wetherill Medal of the Franklin Institute was awarded to DR. L. B. TUCKERMAN of the division of mechanics and sound on May 15. The award was made in recognition of DR. TUCKERMAN'S fundamental improvements in the optical lever and his application of it to his optical strain gage.

E. C. CRITTENDEN, assistant director of the National Bureau of Standards, delivered the opening address at the Twenty-Fifth National Conference on Weights and Measures, on June fourth. The conference (the first since 1931) met at the Bureau on June 4–7, and was attended by 103 weights and measures officials representing 22 States and the District of Columbia, as well as 55 manufacturers of weighing and measuring apparatus and 10 other persons.

National Park Service.—PROF. CAREY CRONEIS, Department of Geology, University of Chicago, and DR. MELVIN BROADSHAUG and DR. V. C. ARNSPIGER, of the Erpi Corporation, were at Washington Headquarters, National

Park Service, June 8 to 10, in connection with final checking on a series of educational films prepared for Civilian Conservation Corps Camps through a cooperative effort between the National Park Service, the University of Chicago, and the Erpi Corporation.

DR. BARNUM BROWN of the American Museum of Natural History spent several days in Washington in early June, at which time he discussed with Park Service officials plans for developing Dinosaur National Monument in Utah.

DR. G. R. WIELAND, Research Associate of the Carnegie Institution of Washington, recently conferred with National Park Service officials regarding proposed developments at the Fossil Cycad National Monument, Wyoming. It is planned to have a committee inspect this area and offer suggestions on the best means of making the scientific features of this monument available to the public.

Carnegie Institution of Washington.—O. H. GISH and K. L. SHERMAN, of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, left Washington the latter part of May for Rapid City, South Dakota, where they have established a ground-station for obtaining continuous registration of the potential gradient and conductivity of the atmosphere. These data are being obtained for use in connection with the discussion of the air-conductivity records which, it is hoped, will be obtained on the stratosphere flight under the auspices of the National Geographic Society and the United States Army Air Corps which is scheduled to take place in June.

HENRY M. STANTON, observer in the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, sailed from New York on June 14 for Peru where he will assist in a program of ionosphere-work at the Huancayo Magnetic Observatory.

Insecticidal Society of Washington.—A promising new scientific society, the Insecticidal Society of Washington, has now been in existence several months. It was organized last autumn, with the following officers: chairman, DR. F. L. CAMPBELL; vice chairman, C. M. SMITH; secretary, DR. J. W. BULGER.

Society of the Sigma Xi.—At the annual banquet and meeting of the Society of the Sigma Xi, on the evening of May 14, membership was conferred on DR. JOHN R. MOHLER, chief of the Bureau of Animal Industry, DR. S. F. BLAKE of the Bureau of Plant Industry, and DR. O. S. ADAMS of the Coast and Geodetic Survey. DR. MOHLER delivered an address on *Explorations beyond the microscope*, DR. BLAKE spoke on the taxonomy of the Compositae, and DR. ADAMS on some mathematical aids in map projecting.

Seismological Society of America.—The tenth annual meeting of the Eastern section of the Seismological Society of America, held at the Dominion Observatory, Ottawa, was attended by a number of Washington seismologists. CAPT. N. H. HECK, U. S. Coast and Geodetic Survey, presented a report on the seismological work of the Survey and also led a symposium on a proposal for listing additional information from seismograms. REV. F. W. SOHON, S. J., presented a report on *Twenty-four weeks of microseisms*. R. R. BODLE read a paper on *Some factors in epicenter determination*, and FRANK NEUMANN one on *Some new data on long-period waves in epicentral areas*.

Five Years of Plant Patents.—Patented flowers, fruits and other plants have not accumulated very fast since the plant patent law went into effect five years ago, on May 23, 1930. Files of the U. S. Patent Office show only 124 plant patents of all kinds, contrasted with the thousands of patents on mechanical devices and processes that pour from inventors' brains every year.

Four classes have thus far proved sufficient for the arrangement of plant patent records: roses, other flowers, fruits and "plants"—the latter category being a catch-all for everything that is not classifiable as either flower or fruit.

Aside from roses, patented flowers have run rather strongly to carnations, dahlias, chrysanthemums and freesias. Among patented fruits, apples, plums, cherries, grapes and avocados are conspicuous. Patented vegetables are conspicuous by their absence, but there is one patented mushroom.

The highest number of plant patents granted to a single applicant is nine, to the estate of the late Luther Burbank. The Burbank patents include two roses, five plums, one peach and one cherry. There are at present, however, several commercial nursery companies that hold numerous plant patents, sold or assigned to them by the inventors. A number of patents have been granted to breeders in England, Holland, Czechoslovakia and other foreign countries; most of these have been assigned to American firms.

News Briefs

The annual meeting of the American Psychiatric Association was held in Washington during the week of May 13.

At the annual meeting of the Trustees of Science Service, new elections to the Board were made, as follows: Dr. Harlow Shapley, director Harvard College Observatory, representing the National Academy of Sciences; Dr. Henry B. Ward, permanent secretary of the American Association for the Advancement of Science, representing that body, and Dr. Ludvig Hektoen director of the John McCormick Institute for Infectious Diseases, Chicago, representing the National Research Council. Dr. Vernon Kellogg, secretary emeritus of the National Research Council, who retired as a trustee, was elected honorary vice-president, in appreciation of his long service in the office of vice-president.

The annual meeting of the American Association of Museums was held at the U. S. National Museum during the week of May 20.

The first topographic map made by white men in China, just after the Boxer uprising over a generation ago, has been turned over to the Library of Congress by R. H. Sargent of the U. S. Geological Survey. Associated with Mr. Sargent in the survey that produced the map were Drs. Bailey Willis and Eliot Blackwelder, now of Stanford University. The expedition had to work under the protection of a Chinese armed escort.

A white oriole, one of the rarest birds in the world, is included in collections turned over to the Smithsonian Institution by Dr. Hugh M. Smith, recently returned from Siam.